IQ^3 Metal Detector User Guide

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Introduction

Inspection systems are widely used and integrated into production lines within a vast range of businesses, including the pharmaceutical, food and beverage industries, to identify metal contamination in products so that they may be removed from the production line and are not supplied to customers.

Loma Systems has been designing and manufacturing metal detection equipment for over 45 years and has earned a reputation for consistent quality and advanced technology.

The following sections provide more information:

- **About this Guide**

  This section provides you with a general introduction to the guide, its purpose and the intended audience.

- **Organisation**

  The guide is organised into a number of chapters providing information in a logical sequence. This section lists and briefly describes the contents of each chapter.

- **Document Change Control**

  This guide is a controlled document which is subject to change in line with changes to our products. As the principle aim of the guide is to provide you with the information that you need, we would welcome any comments or feedback that will enable us to make improvements to the guide. Please email us at manuals@loma.com.

- **Document Key**

  Special text is used throughout the document, highlighted through the use of icons, to add notes and warnings where appropriate.

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About this Guide

General

This guide explains in plain language and by example how to use the IQ^3 Metal Detector Head and Conveyor. It begins with a conceptual overview of metal detection and then walks through the processes required to install, operate and maintain the machine. Each process is cross referenced to detailed information covering the concepts, controls, parts, assemblies, software and items associated with the process.

Audience

This guide is designed for anyone using the IQ^3 Metal Detector. There are four levels of user access to the available features and functionality available, each of which provides specific benefits to that user.

- **Operator**

  The guide benefits operators who need to use the machine functionality and features to carry out routine product inspections and remove any contaminated products from the production line.

- **Supervisor**

  The guide benefits supervisors who need to use the machine functionality and features to manage the selection and inspection of a range of products.

- **Quality**

  This guide benefits quality staff who monitor and analyse inspection data to ensure that acceptable quality standards are achieved and maintained for all products inspected to meet customer and legislative requirements.

- **Engineer**

  This guide benefits engineers and technicians who need to initially install, commission and integrate the machine into the production line and then carry out routine servicing and maintenance tasks to assure the high availability and performance of the machine.

Even if you are not involved directly in using the IQ^3 Metal Detector, this guide provides you with general information for using metal detection to prevent products containing contaminants from being shipped to customers.

Purpose

This guide has two integrated goals:

- **Immediate Success**

  The primary goal is to show users at all levels how to carry out operations and tasks that will ensure the effective, safe and continued operation of the machine to detect metal contaminants in products and remove them from the production line.

- **Continuing Success**

  The secondary goal is to provide metal detection guidelines that can be used when setting up the machine to reliably carry out inspection of specific products.

This guide provides technical and operational information that you can integrate into your in-house documentation, particularly to meet the requirements of legislation and other standards.

Organisation

This guide is organised into the following chapters:

- **Introduction**

  Guidelines provide an introduction to this guide and some general information, including global contact details for Loma Systems.

- **About Metal Detection**

  Guidelines provide an introduction to metal detection, including an explanation of the basic principles and good practice guidelines.

- **Safety First**

  Guidelines identify explain the safety features built into the machine, potential hazards, warnings labelling and other general and legislative information related to the safe use of the machine

- **Technical Specifications**

  Guidelines provide technical information for the machine to generally assist in the site selection and safe installation processes

- **Installation**

  Guidelines explain how to safely install the machine, including the connection of electrical and pneumatic supplies

- **About the Metal Detector Range**

  Guidelines provide a summary of the available features and functions of the machine and descriptions of its component parts.

- **Getting Started**

  Guidelines describe the basic controls and how to switch on, log in and prepare the machine for use.

- **Using the Metal Detector**

  Guidelines provide information covering good practice, establishing detector sensitivities and how to get the best results from your machine.

- **Operating Instructions**

  Instructions are provided describing how to carry set up and configure the machine, including adding new products for inspection and carrying out performance validation testing.

- **Logs and Reports**

  Guidelines identify the types of logs and reports that are available and describe how to output them for analysis.

- **Maintenance**

  Guidelines provide information covering maintenance of the machine to ensure it continues to operate efficiently and safely.

Each chapter is organised in a logical operational sequence and includes cross-references where applicable to related guidelines.

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WARNING - Warnings are used to identify possible hazards which may cause damage to, or malfunction of the equipment, loss of life, bodily damage or ill health in any form, either immediate or latent. Loma Systems cannot be held responsible for injury to anyone, however caused, where Warnings have been ignored or taken lightly.

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Main Run Screen	*Indicates a hyperlink, so tapping on the text will display another page.*
manuals@loma.com	*Indicates an email hyperlink, so tapping on the text will open a new massage window in your email system.*
http://www.loma.com	*Indicates a web hyperlink, so tapping on the text will open the page in your default web browser.*

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About Metal Detection

Industrial metal detectors are used in the pharmaceutical, food, beverage, textile, garment, plastics, chemicals, lumber, and packaging industries.

Contamination of food by metal shards introduced during the manufacturing process is a major safety issue in the food industry. Metal detectors are widely used and integrated into production lines and play a vital role in preventing contaminated products from reaching customers.

The following sections contained in this chapter provide a conceptual overview to explain what metal detection is, the reasons for metal detection, how metal detection works and how to implement metal detection successfully:

- **How a Metal Detector Works**

  All metals are magnetically conductive, electrically conductive or both. When they enter an electromagnetic field they create a detectable disturbance, or signal, in the field and this is used to detect the presence of metal contaminants in food and pharmaceutical products.

- **Product Effect and Phasing**

  Explains what product effect is and how phasing is used to reduce its impact on detecting contaminants.

- **Tracker Feature**

  The Tracker feature when enabled, continuously adjusts the product signal threshold automatically, using the average signal values obtained from a defined number of products that pass through the aperture.

- **Metal Free Zone**

  Although the electromagnetic field is generated inside of the detector housing, some of the field emanates out of the aperture on both sides. This ‘leakage’ area is defined as the Metal Free Zone.

- **Detector Performance**

  Provides details of factors that affect the performance of a metal detector and gives typical levels of detection performance for different product types.

- **Types of Metal**

  Provides details of the types of metal that typically be detected and the ease of detection, dependant on their physical characteristics

- **Shapes and Orientation of Metal**

  Provides information covering how the shape of a metal contaminant and its orientation when passing through the metal detector aperture can affect its detection.

- **Testing Metal Detector Performance**

  Regardless of how sophisticated and reliable a metal detector is, it is only as good as the frequency and thoroughness of the testing programs supporting it. This section provides guidance for testing your metal detector performance.

- **Learn Feature**

  The Learn feature incorporated into the metal detector completely automates the configuration of the detector settings for a product. The Learn process options available are described in this section.

How a Metal Detector Works

General

All metals are magnetically conductive, electrically conductive or both. When they enter an electromagnetic field they create a detectable disturbance, or signal, in the field.

Modern metal detectors allow this signal to be detected, providing the opportunity to operate a reject device to remove the contaminated product from the production line.

The head houses a transmitter coil that broadcasts a low to medium radio frequency (RF) signal which generates the electromagnetic field. Two receiver coils are also located in the head on either side of the transmitter coil.

The receiver coils pick up any disturbance as caused by a metal contaminant. This is then digitally processed to generate a resultant signal. If the signal exceeds the performance threshold set for the product being inspected then detection is triggered, providing an opportunity to remove the contaminated product from the production line.

Balance Stability

Very small movements of the metal detector, caused by temperature changes, vibration from nearby equipment and other factors, can disturb the balance of the three coils. This can cause the metal detector to falsely indicate the presence of metal; commonly called ‘false triggering’.

The robust construction and excellence in electronics and software design of Loma metal detectors provides a stable and reliable product where the likelihood of false triggering is minimised.

General and Foil Wrapped Products

Modern metal detectors fall into two main categories. The first category consists of systems with a general purpose search head. These systems are capable of detecting ferrous and non-ferrous metals as well as stainless steels, in fresh and frozen products; either unwrapped or wrapped and even in metallized films.

The second main category consists of systems which have a ferrous-in foil search head that uses a series of magnets rather than a balanced coil. These systems are capable of detecting ferrous metals within fresh or frozen products which are packed in foil wrapping.

Product Effect and Phasing

Product Effect

Not only are all metals magnetically conductive, electrically conductive or both, but also the products being inspected can also have one or both of these characteristics. In effect, when a contaminated product is passed through the aperture, the metal detector sees a single resultant signal consisting of both the product signal and the metal contaminant signal.

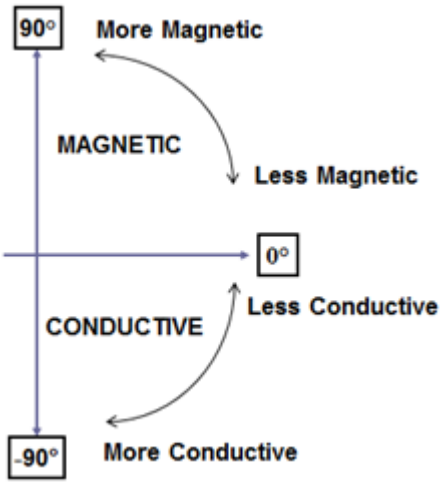
For example, iron enriched products such as cereals create a large magnetic signal that hampers the detectors ability to detect the magnetic signal of small pieces of metal. These are commonly called ‘Dry’ products which typically include meat, cheese, bread, fish, dairy products and salad items.

Conversely, products with high moisture and salt content such as bread, meat and cheeses, are electrically conductive, again hampering the metal detectors ability to detect small pieces of metal. These are commonly called ‘Wet’ products which typically include cereal, crackers, flour, powders, frozen food products and peanut butter.

For the metal detector to identify that the product contains a metal contaminant and trigger detection, the signal from the contaminant must therefore be greater than the product signal.

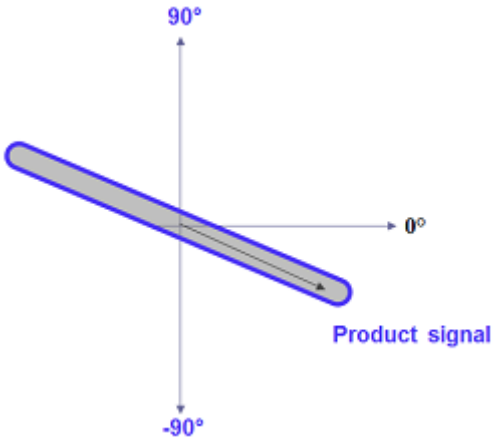
Phasing

The diagram below shows how the magnetic and conductive properties of a product affect the product phase angle.

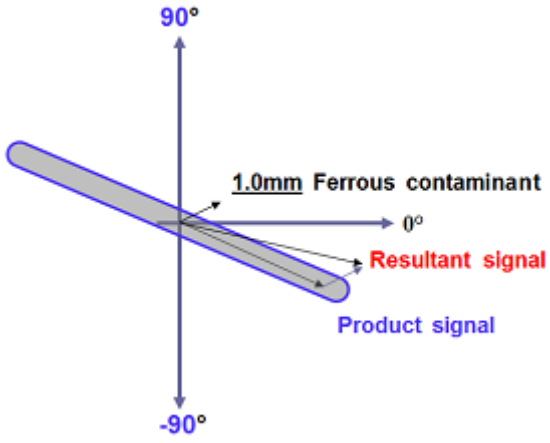


Utilising the 'Learn' feature provided in the IQ^3 Metal Detector, an average for the net signal received from a product during inspection is digitally processed to provide a phase angle and amplitude.

This is then memorised for later recall against the product as a product 'window', as shown in the *Product Signal* diagram below and essentially provides a 'filter' so that signals of a known phase and amplitude can be ignored. This is called 'phasing out' the product signal.



Product Signal



Contaminated Product Signal

The *Contaminated Product Signal* diagram above shows how a signal from a metal contaminant, although much smaller than the product signal, can be easily detected.

The metal detector sees the one resultant signal of the metal contaminant and product signals presented together at the same time.

This resultant signal still falls well outside of the product 'window' which then triggers detection and provides an opportunity for the contaminated product to be rejected from the production line.

Tracker Feature

As well as capturing and memorising the product 'window' during a 'Learn' process, the IQ^3 Metal Detector also includes a Tracker feature which when enabled continuously adjusts the product 'window automatically, using the average signal values obtained from a defined number of products that pass through the aperture. This allows the detector to compensate for slight changes in the phase angle and amplitude of the product signal.

For example, for a frozen product the product effect is very small when the product has just come out of the freezer. This allows a low working threshold level to be used giving a high sensitivity to metal contaminants. However, if the line stops for any reason then the product could thaw slightly, or if the product were not fully frozen, a significant product signal increase may result. In this event the working threshold will have to be raised to allow the product to be passed, without false rejection. Raising the working threshold to allow thawed product to pass without false rejection may reduce the sensitivity to metal contamination. If the product becomes hard frozen the working threshold may be higher than it now needs to be, so the sensitivity to metal contamination will not be as good as it could be.

Tracking works by recording the product signal for each pack. From the values read, the working threshold continuously trends upward or downward between an upper and a lower limit. The rate and amount by which the working threshold changes together with limits between which it operates are controlled by user entered parameters for each product.

It should be noted that this type of system may allow metal contamination that would otherwise be detected if changes in the product force the working threshold to rise sharply.

Tracker initialisation will occur whenever the detector is powered on, the running product is changed or the tracking limit parameters are changed. Upon completion of the product learn routine the derived working threshold will be used unless the product signal initiates a change.

Metal Free Zone

Although the electromagnetic field is generated inside of the detector housing, some of the field emanates out of the aperture on both sides. This 'leakage' area is defined as the Metal Free Zone, meaning an area external to the metal detector aperture which must be free of any fixed or moving metal as it generates a signal that will be picked up by the metal detector and added to the signal being produced by the product and any contaminant. This could result in false triggering and rejection of good products.

Loma Systems generally employ the use of fixed plastic guards fitted around both ends of the aperture. This serves a dual purpose in effectively preventing access to those areas and the accidental introduction of any metal contaminants.

Detector Performance

For optimum detector performance, the search head must be of an appropriate size for the specified product. Smaller apertures generally allow smaller pieces of metal to be detected; the exception being products packaged in metallised film and highly conductive products such as large blocks of cheese.

In production, detector performance is affected by the following:

- Size of detector aperture
- Detector type
- Head operating frequency
- Product temperature
- Conveyor speed
- Environmental conditions
- Product presentation

The tables below provide typical predicted levels of detection provided by the IQ^3 Metal Detector, depending on the height of the head aperture and the product type being inspected.

Each value shown is the diameter in millimetres (mm) of a spherical metal contaminant, as contained in Loma test wands.

The detection performance figures quoted in the tables below are for indication purposes only and are based on previous experience with similar products and applications. The estimation of detection level does not take into account excessive product effect or interference. Full product tests are required to validate any detection performance estimation.

The figures are also based on heads up to 650mm wide. Above this width there will be a drop in performance that could be up to 0.5mm, depending on the width / length ratio.

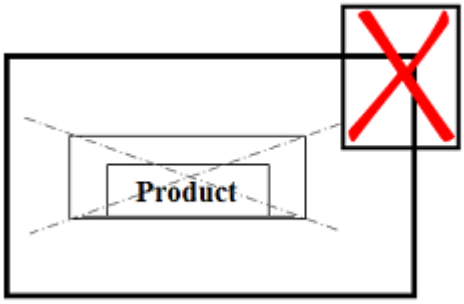
Standard Blue Head Aperture Liner

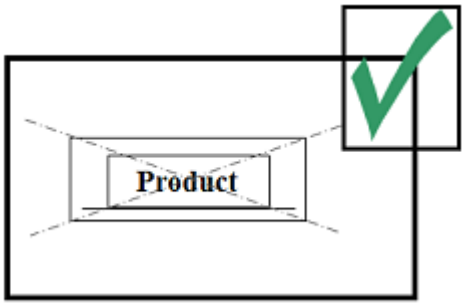
	Dry / Deep Frozen			Frozen / Light Wet			Conductive / Large Wet			Met. film / Difficult		
Aperture Height (mm)	Fe	NFe	304 S/S	Fe	NFe	304 S/S	Fe	NFe	304 S/S	Fe	NFe	304 S/S
100mm	0.8	0.8	1.2	0.8	1.2	2.0	1.0	1.5	3.0	Product testing is advised		
150mm	1.0	1.0	1.5	1.0	1.5	2.5	1.5	2.0	3.5			
200mm	1.2	1.2	2.0	1.5	2.0	3.0	2.0	2.5	4.5			
250mm	1.5	1.5	2.5	1.5	2.0	3.0	2.5	3.0	5.0			
300mm	2.0	2.0	3.0	2.0	2.5	3.5	3.0	3.5	5.5			
350mm	2.0	2.0	3.5	2.5	3.0	4.0	3.5	4.5	6.0			
400mm	2.5	2.5	4.0	2.5	3.0	5.0	4.0	5.0	7.0			
450mm	3.0	3.0	4.5	3.0	3.5	5.5	4.5	7.5	8.0			
500mm	3.0	3.0	5.0	3.0	3.5	6.0	5.0	8.5	9.0			

Ultra Harsh White Aperture Liner

	Dry / Deep Frozen			Frozen / Light Wet			Conductive / Large Wet			Met. film / Difficult		
Aperture height	Fe	NFe	304 S/S	Fe	NFe	304 S/S	Fe	NFe	304 S/S	Fe	NFe	304 S/S
100mm	1.0	1.0	1.5	1.19	1.5	2.0	1.5	2.0	3.5	Product testing is advised		
150mm	1.5	1.5	2.0	1.5	1.5	2.5	1.5	2.5	4.0			
200mm	2.0	2.0	2.5	2.0	2.0	3.0	2.0	3.5	5.0			
250mm	2.0	2.0	3.0	2.0	2.0	3.0	2.5	4.0	5.5			
300mm	2.5	2.5	3.5	2.5	2.5	3.5	3.0	4.5	7.0			
350mm	2.5	2.5	3.5	2.5	2.5	4.0	4.5	5.5	8.0			
400mm	3.0	3.0	4.0	3.0	3.5	4.5	5.5	6.5	9.0			
450mm	3.0	3.0	4.5	3.0	3.5	5.0	6.5	7.5	10.0			
500mm	3.5	3.5	5.0	3.5	4.0	5.5	7.5	8.5	11.0			

Detector performance is also affected by the position of the contaminant in the aperture. The least sensitive point is located in the geometric centre of the aperture, so this ideally is where to test the detector performance each time if practical, to ensure consistency. As metal gets closer to the sides (coils) of the aperture, the signal generated becomes larger, making it easier to detect.





Types of Metal

Metal detector performance is not the same for all types of metal. The ease of detection depends on how easily they are magnetised, the magnetic permeability, and the electrical conductivity of the metal. Metal detectors are calibrated for optimum detection performance of ferrous metals, non-ferrous metals and stainless steel.

- **Ferrous**

  Ferrous materials are any metal that is easily attracted to a magnet, such as steel and iron. Typically ferrous metals are easiest to detect and usually the most common contaminant outside of food processing plants.

- **Non-Ferrous**

  Non-ferrous materials are highly conductive, non-magnetic metals such as copper, aluminium, brass and phosphor bronze. When inspecting non-conductive products, these metals produce almost the same size signal as ferrous metals because they are all good conductors. When inspecting conductive products, increasing the test sphere size by at least 50% is a good practice.

- **Non-Magnetic Stainless Steel**

  High quality 300 series stainless steels, such as types 304 and 316, are the most difficult metals to detect due to their poor electrical conductive qualities and low magnetic permeability. These are commonly used in the food processing and pharmaceutical industries.

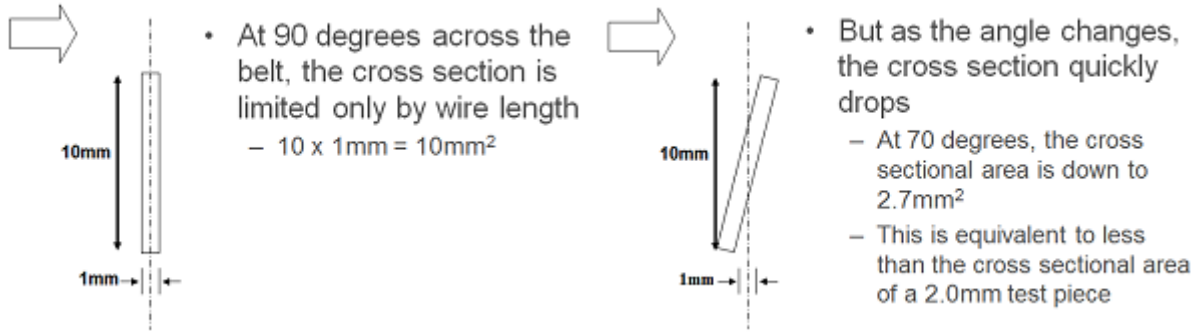
  When inspecting non-conductive products, a stainless steel test sphere typically needs to be 50% larger than a ferrous sphere to produce the same size signal. When inspecting conductive products, a stainless steel test sphere needs to be 200% to 300% larger than a ferrous sphere to produce the same size signal.

  When detection specifications include non-ferrous and/or stainless steel, the particular metals and sizes should be identified. Correct identification of what particles should be detected is critical because these metals have many varieties and they will all look slightly different to the metal detector.

Shapes and Orientation of Metal

Metal detector standards are based on testing using sphere shaped pieces of different types of metal and in different sizes. This is because spheres are the same shape and size when viewed from any angle.

Real contaminants are rarely spherical so may produce different signals depending on their orientation as they pass through the aperture. Wire contaminants are the most dramatic example of this as shown in the diagrams below.


10mm
1mm
• At 90 degrees across the belt, the cross section is limited only by wire length
– 10 x 1mm = 10mm²
10mm
1mm
• But as the angle changes, the cross section quickly drops
– At 70 degrees, the cross sectional area is down to 2.7mm²
– This is equivalent to less than the cross sectional area of a 2.0mm test piece

A common solution to this problem is to use two metal detector heads positioned at different angles across the conveyor belt so that the contaminant is presented at a different angle to both detectors.

Testing Metal Detector Performance

Regardless of how sophisticated and reliable a metal detector is, it is only as good as the frequency and thoroughness of the testing programs supporting it.

Testing and recording are essential components of any HACCP system and must be supported by clearly documented testing procedures that are communicated to all staff using the detector and are monitored and reviewed on a routine and regular basis to ensure compliance with customer and legislative requirements.

Test Frequency

Intervals between tests need to be short enough that if a fault is found, products potentially affected have not left your premises and can be identified, recalled and retested. Once again, if your company is a private label manufacturer, ensure that you agree upon any variation you make to testing procedures, in writing, with your retailer customers.

To facilitate effective testing, all of Loma's Metal Detectors have an integral Performance Validation System (PVS) feature. This feature can be set up to automatically prompt the operator to carry out the required test at a pre-set interval.

Product Test Samples

Some guidelines for the provision of product test samples are listed below.

- Ensure that the samples are representative of a good product in all respects.
- Ensure that the samples are free from metal contaminants.
- Mark or label the samples to identify them and prevent them being despatched to customers.
- Produce fresh samples for testing at a frequency that reflects the nature, durability and shelf life of the product concerned. ‘Stale’ test packs may produce different product signals.

Test Wands

Loma Systems metal detectors are supplied with a set of plastic test 'wands' which contain spherical pieces of various metals in different sizes. These are convenient and easy to place into your test samples and also make the testing process even more efficient.

Generally the types of metal and sizes provided will include those covering the specific detection requirements for the customer.

Loma Systems offer a wide variety of spare test wands. To purchase additional test wands please email teststicks@loma.com.

Testing Guidelines

You may be working to specific Customer Codes or Practice to test detector performance, but some general guidelines for testing product samples are listed below.

- Sample products should be tested with both ferrous and non-ferrous test wands.
- When testing finished packed products on a conveyor system, place the test wand, where possible, at the extreme end of the pack. If this is impractical, for example if you are testing individual small packs or sandwich wedges, place the test wand in the centre of the product.
- Test samples should be passed through the search head two times, first, with the test wand at the leading edge of the pack and then with the test wand at the trailing edge of the pack.
- When using a reject device, ensure that test samples which have a test wand attached successfully enter the reject bin or that the conveyor stops when using 'Stop on Detect'.
- Wherever possible, fit metal detection equipment on your production line AFTER products have been wrapped. Where this is not possible and you are manufacturing private label goods, it is advisable to agree to the testing routine, in writing, with the retailer concerned.
- Should any part of your test fail, isolate all products produced since the last satisfactory test and re-screen them, using another detector functioning to the same standard as the original system performing the test.

Test Records

When testing is carried out using the in built Performance Validation System (PVS), the results are recorded automatically by the system.

If a serial link has been set up to connect to a printer or networked PC, a PV Test Report is automatically generated and sent directly to the printer or after a PV test has been completed.

The PV test details are also available by navigating to the ***Menus > Logs*** menu, selecting PVS and navigating to and selecting the **View PVS Log?** menu option.

When testing is carried out manually, the results must be manually recorded and should include the following:

- Line or detector identification.
- Date and time of the test.
- Details of the sample(s) used.
- Identification of the operator/tester.
- Results of the test (pass / fail).
- Corrective action taken if the result was failure.

Learn Feature

Purpose

The Learn feature incorporated into the metal detector completely automates the configuration of the detector settings for a product. Three Learn process options are available.

Full Learn

The Full Learn process consists of following displayed instructions to pass a number of product samples through the detector aperture.

The product samples used during any Learn process must be representative of the product to be run and known to be free from metal contamination.

Normally at least eight product samples will be required. By using more than one sample the detector can make adjustments if necessary for differences that may occur across the samples used.

A single product sample could be repeatedly passed through the detector but the resulting Learn may not be as good and require an update when the product line is run

The best results will be obtained by passing the product samples in succession through the detector in the time period dictated by the on-screen instructions. If possible you should Learn the product on a running line so that the detector learns a product as it would normally be run.

See the Full Learn section for further details.

Update Learn

The Update Learn process consists of following displayed instructions to pass a number of product samples through the detector aperture. This process can only be used for products that have already gone through a Full Learn process. See the Update Learn section for further details.

Reverse Learn

The Reverse Learn process consists of following displayed instructions to pass a number of product samples through the detector aperture. The detector in this mode is used to pass products that are identified as containing a metal contaminant and reject products that do not.

For example, a product may contain a metal toy so the detector is used to pass products which contain the toy and reject those that don't.

Learn Setup

You are able to make some manual adjustments to the Learn process settings, either before or after carrying out a Learn process. See the Learn Setup and Learn Limits sections for further details.

Safety First

The safety of all people carrying out any activities associated with the installation and use of the metal detector is of primary importance. This chapter is therefore included to provide you with general safety guidance. The following sections provide more information:

- **Safety Awareness**

  All personnel engaged in activities associated with the installation of the metal detector should read and comply with the instructions and information contained herein, the statutory requirements and regulations, including the provisions of the Health and Safety at Work Act (UK), and in line with other international standards.

- **EC Declaration of Conformity**

  Provided it is installed, operated, serviced and maintained in accordance with the guidelines contained in this User Guide, the metal detector complies with the appropriate EU Directives which are listed in this section. A signed EC Declaration of Conformity is supplied with each metal detector.

- **Safety Warnings**

  A number of general safety warnings appropriate for the use of Loma metal detectors is provided in this section. It is essential that personnel who are, or will be, responsible for installing, maintaining or operating the metal detector described in this manual should read and understand these warnings.

- **Safety Labels**

  Safety labels are attached or etched in appropriate places to highlight areas of the metal detector where caution should be taken to avoid potential hazards. The labels used are listed and described in this section.

- **Safety Guards**

  For Loma metal detectors the use of guarding, including covers, panels, curtains and other methods is extremely important in order to restrict operators from accessing areas of the metal detector that are potentially hazardous which the machine is operating. This section provides some guidance on checking the guards.

- **Responsibilities and Disclaimer**

  The metal detector warranty provided by Loma System is subject to it being used and maintained in accordance with a set of guidelines which are included in this section.

- **Safety Measures**

  Before attempting to use the metal detector a number of basic checks should be carried out to ensure that it is in a safe condition and ready to be used. A list of recommended checks is included in this section.

- **Intended Use of the Metal Detector**

  Loma metal detectors are designed to be used in an industrial environment for detecting metal contaminants in products presented in packets, pouches or loose products. Any improper use could invalidate the EC Declaration of Conformity issued with the metal detector and also the metal detector warranty. This section provides further details.

- **Noise Levels**

  Loma metal detectors do not emit a level of noise that is hazardous. However, in line with current legislation, the customer should verify that the overall noise levels within the operating environment are within defined limits.

- **End of Life Treatment**

  The Waste Electrical and Electronic Equipment recycling (WEEE) Regulations 2006 and the CE Directive 2002/96/EC require that electrical and electronic equipment must be recycled at the end of its useful life. This section provides some guidelines.

- **Emergency Procedures**

  This section lists the potential emergencies that may be encountered and the associated procedures.

- **Quality Assurance**

  If your business is operating under an approved Quality Management System, all activities covering the safe operation and maintenance of the metal detector will need to be incorporated into the system to ensure continued compliance. This section provides some guidelines on what needs to be considered.

- **End User Licence Agreement**

  This section contains details of the End User Licence Agreement for the metal detector software.

Safety Awareness

Loma metal detectors employ low intensity electromagnetic fields in compliance with current legislation.

If used in close proximity to an electromagnetic field, the operation of pacemakers, cardiac defibrillators and other life support devices can be affected.

Wearers of these devices should consult their doctor for advice on avoiding this hazard.

It is essential that all installation, operation and maintenance personnel read this guide before working on the IQ^3 metal detector and comply with the instructions and information contained herein.

It is also essential that all personnel engaged in activities associated with the installation, operation, servicing and maintenance of the IQ^3 metal detector have been adequately trained and are appropriately qualified and experienced to do so.

All personnel should comply with the statutory requirements and regulations, including the provisions of the Health and Safety at Work Act (UK), other EU relevant legislation, relevant OSHA regulations, and any amendments that may become legal requirements.

EC Declaration of Conformity

Provided it is installed, operated, serviced and maintained in accordance with the guidelines contained in this document and the appropriate User Guide, the metal detector addresses the fundamental safety and health requirements of the following directives:

- EC Machinery Directive **2006/42/EC**
- EC Electromagnetic Compatibility Directive **2004/108/EC**
- EU-Directive **1935/2004/EC** (Materials for Food Contact)
- EU-Directive **2011/10/EC** (Plastic Materials and Articles intended to come into contact with food).

A signed and dated EC Declaration of Conformity is provided with each metal detector delivered.

Any modifications made to any part of the metal detector without the prior written agreement of Loma Systems will invalidate the EC Declaration of Conformity and also the product warranty.

Safety Warnings

Listed below are the safety warnings that are applicable when using a Loma metal detector. It is strongly recommended that personnel who are, or will be, responsible for installing, maintaining or operating the equipment described in this manual should read and understand these warnings.

Systems manufactured by Loma are specifically designed for automatic in-line operation. Operators are normally only required to work on the machine intermittently and this interaction is usually limited to either changing product settings via the system control panel or emptying product from the reject receptacle.

Engineers involved in installation, servicing and maintenance of the metal detector may be exposed to hazards in the execution of particular actions so are advised to be particularly vigilant and take into account the potential hazards listed.

1. **LETHAL HAZARD – ELECTRICAL SUPPLIES**. A current of 100 milliamps passing through the body for one second can kill. This can occur at voltages as low as 35V ac or 50V dc. The equipment described in this manual uses electrical power which can be lethal. Unless absolutely necessary, cleaning, inspection and maintenance must not be carried out without first isolating the equipment from all electrical supplies.
2. **LETHAL HAZARD – COMPRESSED AIR SUPPLIES.** The equipment described in this manual may be supplied with a compressed air supply operating at a pressure which may be lethal. Unless absolutely necessary, cleaning, inspection and maintenance must not be carried out without first isolating the equipment from all compressed air supplies.
3. **NON-IONIZING RADIATION**. Loma metal detectors employ low intensity electromagnetic fields in compliance with current legislation. If used in close proximity to an electromagnetic field, the operation of pacemakers, cardiac defibrillators and other life support devices can be affected. Wearers of these devices should therefore consult their doctor for advice on avoiding this hazard.
4. **WORKING ON EQUIPMENT.** If it is essential to work on the equipment with electrical and/or compressed air power connected, the work must be undertaken only by qualified personnel who are fully aware of the danger involved and who have taken adequate safety precautions to avoid contact with dangerous voltages and/or compressed air supplies. Before disconnecting the metal detector from power, removing the power plug or loosening the power terminals ensure that signal cables to other machines are disconnected first. Take care not to trap the earth wire or ribbon cable when closing the enclosure lid.
5. **REJECT DEVICES.** At no time, with compressed air and/or electrical power applied to an automatic reject device, should any part of the body be placed within the operating area of the reject device.
6. **EXCESSIVE NOISE.** When an air blast reject device operates, the noise emitted may constitute a noise hazard. While short exposure to this noise will not cause permanent damage to hearing, prolonged exposure may cause some damage. It is recommended that ear defenders are worn by personnel who are regularly exposed to the noise.
7. **HEAVY EQUIPMENT.** Loma metal detectors are extremely heavy and considerable care must be taken when handling them. Sufficient personnel and a suitable fork-lift truck or pallet truck must be used to ensure safe handling.
8. **LIFTING THE MACHINE.** Use only the correct slings and lifting tackle to move Loma metal detectors. Visually inspect all slings and lifting tackle prior to lifting the machine to ensure that:
    a. The safe working load will not be exceeded.
    b. There are no frayed or broken strands.
    c. Hooks, rings, etc. are not damaged.
9. **MOVING THE MACHINE**. The centre of gravity of some metal detectors is high. Lower the height adjustment to its minimum before moving. Care must be taken when moving a metal detector on a slope to ensure that it does not topple over. This could result in death or severe injury to an individual and/or severe damage to the equipment.

10. **CONTAMINANTS**. Oils and greases must always be handled with care. Prolonged bare skin exposure to certain oils and greases can cause skin problems. Always handle oils and greases in accordance with the manufacturer‘s instructions.
11. **TRAPPED FINGERS**. Do not place fingers on the underside of the conveyor when the metal detector is operating. It is possible for fingers to be trapped and subsequently crushed between a moving and fixed component.
12. **WARNING LABELS**. Loma metal detectors have a number of safety labels attached to highlight potentially hazardous areas. Particular attention should be paid to the location of these labels and their significance in operating the metal detector safely. If necessary, labelling is provided in the local language to meet legislative requirements.
13. **GUARDS**. No metal detector is to be run without guards fitted unless for maintenance purposes and only if adequate precautions have been taken. Under no circumstances is any interlock to be defeated.
14. **OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION WARNING**. In the USA, the Occupational Safety and Health Administration (OSHA) Acts quite clearly place the burden of compliance on the user of equipment, and the acts are generalised to the extent that determination of adequacy of compliance is a judgement decision on the part of the local inspector. Hence Loma cannot be held responsible for meeting full requirements of OSHA or OHSA. with regards to any equipment supplied, nor can Loma be held liable for penalty which may be assessed for failure to meet the requirements of the acts as interpreted by an authorised inspector.
15. **LIABILITY.** This machinery contains high voltages of a hazardous and potentially fatal nature. Loma Systems cannot accept any liability for death or bodily injury resulting from improper work undertaken by unqualified operatives, or due to deviations from the maintenance instructions within this manual. This Liability statement is in addition to the terms of sale.
16. **HEIGHT ADJUSTMENT.** Care should be taken when adjusting the height of Pipeline detectors. Lower the height adjustment to its minimum before moving. If appropriate measures are not taken, severe injury to an individual or damage to the detector could result.
17. **SECURITY WHEN STAND MOUNTED.** Due to the high centre of gravity, care should be taken when moving a pipeline metal detector on a stand as the applied force and/or obstructions of the wheels may cause the machine to fall over. This could result in death or severe injury to an individual and/or severe damage to the detector.
18. **START UP WITH AUTOMATIC REJECT VALVE.** When a pipeline is switched on, the automatic reject valve changes state from “Reject” mode to “Run” mode. Do not put any part of the body within close proximity of the reject valve outlet when the machine is switched on. This could result in severe injury to an individual.
19. **HEIGHT ADJUSTMENT STAND-MOUNTED VERSIONS.** When adjusting the height of a detector assembly, do not unscrew the locating screw in the height adjustment strut. If it is unscrewed and removed, the body of the detector and the reject valve may spin round on the height adjustment strut, causing the machine to fall over. This could result in death or severe injury to an individual and/or severe damage to the detector.
20. **SECURITY.** The detector is mounted on a gas-filled height-adjustment strut. After adjusting the height of the detector, make sure the adjustment handle is fully tightened. If the handle is not fully tightened,the detector could rise on the strut. This could result in severe injury to an individual and/or severe damage to the detector.
21. **HANDLING A HINGE MOUNTED VERSION ON A HANDTMANN PA30 FILLER.** When a pipeline is mounted on a PA30, the detector must be removed from the PA30 before disconnecting the PA30 from the main filler. Failure to do this may result in the PA30 falling over resulting in death or severe injury to an individual and/or severe damage to the PA30.
22. **HANDLING A HINGE MOUNTED VERSION WITHOUT A STAND.** Care should be taken when fitting or removing the detector off the filler hinge. The detector should be lifted by two persons. If lifting is attempted by a single person this could result in death or severe injury to an individual and/or severe damage to the detector.

23. **HANDLING A HINGE MOUNTED VERSION ON A STAND.** Care should be taken when moving a detector as applied force and/or obstructions of the wheels may cause the machine to fall over. Remove all attachments before disconnecting from the filler. Lower the height adjustment to its minimum before moving. Failure to do this may result in the detector falling over. This could result in death or severe injury to an individual and/or severe damage to the detector.
24. **HANDLING WITH A WATER JACKET FITTED.** When a pipeline is fitted with a water jacketed product pipe, surface temperatures of the product pipe and the water jacket coil may be up to 75 °C. Contact with the product pipe or the water jacket coil may result in minor burns or light scalding.
25. **OPERATING WHEN USED FOR HANDLINKING.** When a pipeline is fitted to a filler and used for handlinking, the location of the filler knee control lever is located closer to the detector infeed than the detector outfeed.
26. **DISCONNECTION OF POWER.** Before disconnecting the metal detector from power, removing the power plug or loosening the power terminals ensure that signal cables to other machines are disconnected first.

Safety Labels

Safety labels are attached or etched in appropriate places to highlight areas of the metal detector where caution should be taken to avoid potential hazards. The labels used are listed and described below.

Label	Message
	CE Mark / Machine identification etched on the machine includes: ■ Power supply data ■ Date of Manufacture ■ Serial Number
	Caution: Electric Shocks Includes voltage and phase details which will vary dependant on the available supply.
	Caution: Hazardous Machinery All machinery has a potential for being hazardous if the appropriate level of care is not taken and any safety warnings not followed. Caution: Pneumatic Reject Device Reject devices operate very quickly to remove contaminated products from a fast moving production line. Care should be taken to avoid contact with a reject device when it is operating
	Caution: Pinch Point Moving parts of machines, specifically conveyors, provide opportunities for trapping fingers or even items of clothing in the mechanism if care is not taken.

	Caution: Isolate Machine Before Maintenance Electrical power should be disconnected before carrying out maintenance operations that expose staff to potentially lethal voltages. Caution: Isolate air supply before maintenance Compressed air should be disconnected before carrying out maintenance operations where reject devices could be activated accidentally.

Safety Guards

Under no circumstance must a machine be operated with any guarding removed or interlock switches defeated.

Guarding

For Loma metal detectors the use of guarding, including covers, panels, curtains and other methods is extremely important in order to restrict operators from accessing areas of the machine that are potentially hazardous whilst the machine is operating or to prevent exposure to potentially hazardous ionising and non-ionising radiation.

Interlock switches

On some machines, access hatches are incorporated into the guards to provide access to some areas of the machine to, for example, clear obstructions and remove products when required. These hatches are fitted with an interlock switch so that when a hatch is opened, the machine will switch off and a fault condition is generated.

Safety Relay and Circuits

As safety is paramount, at least one fail safe relay is fitted to ensure that if a contact of the interlocks were to fail the safety relay will automatically detect the fault and therefore switch off the metal detector and generate a fault condition.

Responsibilities and Disclaimer

Unless agreed otherwise in writing by Loma Systems, any warranty claims are subject to the following:

- No unapproved changes or additions to the electrical wiring system have been carried out.
- No unapproved mechanical changes or additions to the system have been carried out.
- No unapproved electronic changes or additions to the system have been carried out.
- No unapproved changes or additions to the system software have been carried out.
- Cleaning of the metal detector has been carried out in accordance with the Cleaning Cleaning guidance included in this User Guide.
- The metal detector has not been subjected to operation, or an environment, that is outside of the parameters included in the machine's Technical Specifications.
- The metal detector has only been used for the purpose for which it has been sold, as specified in the contract.
- Maintenance Maintenance tasks have been carried out in accordance with the guidance included in this User Guide.

- Any spare parts required are obtained from Loma Systems by sending an email to sales@loma.com.

Safety Measures

Before attempting to use the metal detector, carry out the following basic checks to ensure that it is in a safe condition and ready to be used:

- Check that the electrical power and air supply, if being used, are connected correctly and are working normally.
- Check that the conveyor is clean and clear of any products or other items.
- Check that there are no metal or other items resting on top of the metal detector, particularly around the search head.
- Check that all inspection hatches, the reject bin door and the Electrical Services Box are closed and locked.
- Check the area in front of metal detector to ensure that it is clean and clear of any potential trip or slip hazards.
- Check the control panel to ensure the metal detector is working correctly and no warning or error messages are being displayed.

In addition, the following points should be observed for safe operation of the system:

- Installation, commissioning, operation and maintenance of the metal detector should only be carried out by trained personnel, following the applicable safety measures.
- Servicing and repair of the metal detector must be carried out by qualified Loma or approved customer personnel to avoid damaging the machine, which could result in the introduction of a safety hazard and the loss of warranty cover.
- Care should be taken when carrying out tasks in areas of the metal detector that are potentially hazardous; as identified with an appropriate safety label.
- Removal of any guards, covers and other protective devices must only be carried out by authorized or qualified personnel after first switching off and removing any power from the metal detector.
- Note that interlocking devices are fitted to all inspection covers to automatically stop the conveyor when a cover is opened.
- For the protection of operating personnel, safety switches are installed in easily accessible places on the metal detector, all of which trigger an EMERGENCY STOP.
- All safety devices must be functional at all times! Damaged protective devices or covers must be repaired or replaced immediately! When safety components are replaced, the protective devices are to be properly attached and tested by the operator.

If you require spares or service / repair of your machine, please send an email to enquiries@loma.com.

Intended Use of the Machine

Permitted Use

Loma metal detectors are designed to be used for detecting metal contaminants in products presented in packets, pouches or in loose products.

Loma metal detectors ensure product safety, equipment protection and regulatory compliance by automatically removing contaminated products from the production line, stopping the line, alerting the operator or a combination of these.

Improper Use

- Loma metal detectors are not domestic appliances and should only be used in an industrial environment.
- Loma metal detectors are not suitable for installation or use in explosive or potentially explosive atmospheres.
- Metal detectors must only be installed, operated, serviced and maintained in accordance with the instructions included in this User Guide.
- Electric arc welding must not be carried out on any part of the metal detector unless authorised by Loma Systems.
- All mechanical and electrical protection devices must not be removed or reduced.
- The metal detector is not designed for use in hazardous environments where there is a risk to the health and safety of the operator.
- The metal detector must not be operated in very dry environments which can generate electrostatic charges.

Noise Levels

Generally in an industrial environment some background noise is present due to the operation of electrical equipment and mechanical movements of machinery such as conveyors and motors.

Loma metal detectors do not emit a level of noise that is hazardous. However, in line with current legislation, the customer should verify that the overall noise levels within the operating environment are within defined limits.

End of Life Treatment

In accordance with the Waste Electrical and Electronic Equipment recycling (WEEE) Regulations 2012/19/EU and CE Directive 2002/96/EC, electrical and electronic equipment must be recycled at the end of its useful life.

The metal detector is considered to be a Large-scale Stationary Industrial Tool (LSIT) as defined in Article 2 of the WEEE Regulations. Consequently it is the responsibility of the user of the equipment to ensure the safe disposal of the machine at the end of its useful life.

Emergency Procedures

1. **EMERGENCY SHUTDOWN.** This metal detector is fitted with an emergency **'Stop'** button. This is mounted on the front panel and is coloured red. In the event of an emergency, which requires the System to be immediately stopped, press the **'Stop'** button. See Starting and Stopping for further details. See Starting and Stopping for further details.
2. **DEALING WITH FIRE.** In the unlikely event of fire occurring in an item of equipment manufactured by Loma Systems, it is important that a fire extinguisher containing the correct type of extinguishing material is used. Fire on electrical equipment must be extinguished using a dry powder extinguisher (Blue label).
3. **AUDIBLE WARNINGS.** A conveyor may be fitted with an alarm which operates when a metallic contaminant is detected in the product. The maximum volume of the alarm is type dependent and lies in the range of 110 dB(A) to 125 dB(A) at 1 metre.
4. **VISUAL INDICATIONS.** The metal detector may optionally be fitted with indicator lamps, which operate to show a particular status or in the event of a fault condition. The metal detector must not be operated unless all such indicators are fully operational. There are also more detailed fault listings displayed on the operator screen.

Quality Assurance

By your selection of a Loma IQ^3 metal detector system you have demonstrated your intention to assure the quality of your products, and thereby protect your customers.

The following points are recommended:

1. Once your Loma metal detector is installed you should contact your local Loma Service Department to have it commissioned.
2. Regularly test the operation of the metal detector to monitor its detection performance. Keep accurate records of those tests and any samples being used, along with the product details.
3. If the metal detector fails a test, quarantine the product from the last test and re-introduce through the system once the metal detector is fit for use.
4. Have the metal detector supported by a Planned Preventative Maintenance Contract. Details can be obtained from your local Loma Service Department.
5. If you have or intend to have BS EN 9000 accreditation, write a section into your Operating Procedures Manual covering the operation and maintenance of the metal detector and have it regularly calibrated with a certificate issued.
6. Finally, at least on a yearly basis and when any changes or additions have been made, have your operators, QA and maintenance personnel trained in the use of the metal detector. Details of available training can be obtained from your local Loma Service Department. Details of available training can be obtained from your local Loma Service Department or by sending an email to enquiries@loma.com.

ISO9000

Certificates of Calibration

This type of calibration is confined to the checking of the electronics of the metal detector against the original specification, carrying out any adjustments or repairs as necessary. This is normally carried out by the manufacturer against a written specification and using equipment traceable to national and international standards. A certificate of calibration would then be issued for the metal detector. Loma recommend this calibration should be done at least yearly.

Product Learn Process

This process is carried out by the user and involves passing the product through the metal detector according to the requirements of the particular calibration system in use. This optimizes the metal detector for the best performance.

Metal Test Wands

It is recommended that all detector performance checking is conducted using Loma test wands which use metal spheres certified and traceable to national and international standards and plastics which comply with the EU- Directive **2011/10/EC** (Plastic Materials and Articles intended to come into contact with food). Loma can supply upon request certificates of conformity for test wands supplied either with new equipment or as spare parts.

Please note that test wands do not require annual calibration. However, the condition of the test wands must be inspected regularly for damage or deterioration such as cracks, corrosion, water ingress, general wear and loss of markings that could affect hygiene and performance. It is recommended that any suspect test wands are destroyed and replaced.

Loma can supply a vast range of test wand types / sizes at-stock. Specials can also be made to order. Please email teststicks@loma.com for further details.

Work Instructions, Training and Record Keeping

It is recommended that in line detector performance testing is covered by written instructions, thus ensuring a clear and consistent approach by operators at all times and providing the means to substantiate your methods to any assessment body who may ask.

It is recommended that all personnel who may conduct testing are suitably trained to do so and records are kept to substantiate that training.

Accurate, easily retrievable records should be kept in a safe place for a defined period.

End User Licence Agreement

The software used within the IQ^3 Metal Detector is protected by copyright laws and international copyright treaties. The software in the IQ^3 Metal Detector is licensed not sold.

1. Grant of Licence:

Loma Systems shall at all times have and retain title and full ownership of all software, firmware programming routines, documentation supplied for use with the equipment and of all copies thereof made by Buyer (collectively “software”).

Loma Systems grants the Buyer a non-exclusive and non-transferable license to use such software solely for use with the equipment.

The Buyer shall take all reasonable steps to protect Loma Systems proprietary interest in the software and shall not transfer or otherwise provide or sub-licence the software to any third party.

2. Rights and Limitations:

The software is licensed as a component within the IQ^3 Metal Detector only, and may not be separated for use elsewhere.

The software is licensed with the IQ^3 Metal Detector as a single integrated product. The software may only be used with the IQ^3 Metal Detector.

You may not rent of lease the software.

You may permanently transfer all of your rights under this EULA only as part of a sale or transfer of the IQ^3 Metal Detector, provided you retain no copies, you transfer all of the software and the recipient agrees to the EULA.

3. Patents:

The following patents associated with the design of Loma Systems metal detectors have been granted:

- GB2499239B
- GB2506931B

Technical Specifications

IQ^3 Metal Detector Head

The technical specification for the IQ^3 Metal Detector Head is provided in the table below. Please note that this specification lists the available options in some cases. The exact specification for your metal detector head will depend on the options you have selected.

General	
Dimensions	Metal detector heads are available in a range of heights and widths to suit a specific customer requirements, which are agreed prior to manufacture and confirmed on the Order Acknowledgement provided. Please review this document for dimensional information.
Power Requirements (Voltage)	
Standard Options	220/230V, 1-phase, 50Hz, neutral and earth 110/120V, 1-phase, 60Hz. neutral and earth
Environment	
Operating Temperature	- 10°C to 40°C
Relative Humidity	0 - 95% (non-condensing)

Working product pressures may be limited depending on the overall line configuration, including any automatic reject device if fitted.

European Belt Conveyors

The technical specification for all European Belt Conveyors is provided in the table below. Please note that this specification lists the available options in some cases. The exact specification for your machine will depend on the options you have selected.

General	
Dimensions	Each machine is designed to suit a customer's requirements. These are agreed prior to manufacture and confirmed on the Order Acknowledgement provided. Please review this document for dimensional information.
Power Requirements (Voltage)	
Standard Options	380/400/440V, 3-phase, 50Hz. neutral and earth 380/400/440V, 3-phase, 50Hz. earth but no neutral 220/230/240V, 1-phase, 50Hz. neutral and earth 220/230/240V, 3-phase, 50Hz. earth but no neutral
US Voltage	120V, 1-phase, 60Hz, 240V, 1-phase, 60Hz
Control Voltage	24V ac, 50Hz
Power Consumption	350VA
Air Supply (Pusher and Retracting Reject)	
Optimum Pressure	80 psi (5.5 bar)
Minimum Pressure	65 psi (4.5 bar)
Maximum Pressure	90 psi (6.2 bar)
Capacity	10 litres/second at 100 psi (6.9 bar)
Air Supply (Air Blast Reject per nozzle)	
Optimum Pressure	100 psi (6.9 bar)
Minimum Pressure	100 psi (6.9 bar)
Maximum Pressure	120 psi (8.2 bar)
Capacity	27 litres/second at 100 psi (6.9 bar)
Environment	
Operating Temperature	- 10°C to 40°C
Relative Humidity	80% up to 31°C (86°F) reducing to 50% @ 40°C (104°F)

Installation

This chapter provides generic information covering the installation of the Loma IQ^3 Metal Detector in a logical sequence, both as a head only and as a system with the head fitted to a Loma conveyor.

The following sections provide more information:

- **Installing a Metal Detector Head**

  Provides guidance for installing a metal detector head only.

- **Installing a Metal Detector System**

  Provides guidance for installing a metal detector system, consisting of a metal detector head fitted to a Loma conveyor and including standard and optional equipment.

- **Site Considerations**

  All Loma machines are designed and tested against recognised international standards for Electromagnetic Compatibility, to operate under factory conditions. This section provides further information on the impact of RF interference.

Installing a Metal Detector Head

This section provides information covering the installation of a Loma IQ^3 Metal Detector Head in a logical sequence.

The following sub-sections provide more information:

- **Warnings**

  A list of applicable safety warnings to be observed when installing the metal detector head is provided.

- **Receiving and Unpacking**

  Some basic checks should be carried out on receipt of the machine to ensure that it has not been damaged in transit.

- **Moving the Detector Head**

  Depending on the size and weight of the detector head, either a crane or a fork-lift truck will be required to lift and move it into the final location. This section provides some guidance for moving the machine safely.

- **Detector Head Mounting Positions**

  Diagrams are included to provide details for mounting detector heads in different positions.

- **Mounting a Detector Head onto a Conveyor**

  There are a number of points to consider when fitting a new Loma Metal Detector head to an existing conveyor of whatever manufacture, or when building a new conveyor to incorporate a metal detector head. This section provides some guidance.

- **Connecting the Detector Head Electrical Supply**

  This section provides guidance on connecting an electrical supply to the detector head.

Warnings

The following safety warnings apply when installing an IQ^3 Metal Detector head:

1. LETHAL HAZARD – ELECTRICAL SUPPLIES
2. LETHAL HAZARD – COMPRESSED AIR SUPPLIES
3. NON-IONIZING RADIATION
4. WORKING ON EQUIPMENT
5. REJECT DEVICES
6. EXCESSIVE NOISE
7. HEAVY EQUIPMENT
8. LIFTING THE MACHINE
9. MOVING THE MACHINE
10. CONTAMINANTS

For details see the Safety Warnings section.

The following emergency procedures apply to these procedures:

2. DEALING WITH FIRE.

For details see the Emergency Procedures section.

Receiving and Unpacking

Receiving the Detector Head

- On receipt of your Loma metal detector head, we recommend that you check the external packing for any signs of damage.
- If the external packaging is damaged do not refuse the shipment but make a notation on the carriers delivery receipt and take pictures of the packaging damage.
- When moving the detector head, please follow the guidance included in the Moving the Detector Head section.

Unpacking the Detector Head

- Remove all packing and retain in case the detector head has to be repacked for return.
- If on unpacking the detector head it is subsequently found to be damaged, take further pictures of the damage and send them to Loma Systems. Loma Systems will then carry out an investigation, including a review of the applicable carriage terms / Incoterms, to decide what action is to be taken.

Moving the Detector Head

The detector head will be supplied on a wooden pallet in protective wrapping and secured to the pallet with nylon straps. Before unpacking, the detector head can be moved whilst attached to its pallet using a fork lift. Once the packing and retaining straps have been removed the detector head is best moved using a crane to move it into the final location.

Using a Crane

- Position the straps around the detector head so that it will not tilt when lifted. Then attach the straps to the crane.
- **NEVER** put straps through any aperture.

- Lift the detector head carefully and move it to the required location.
- Lower the detector head and remove the straps.

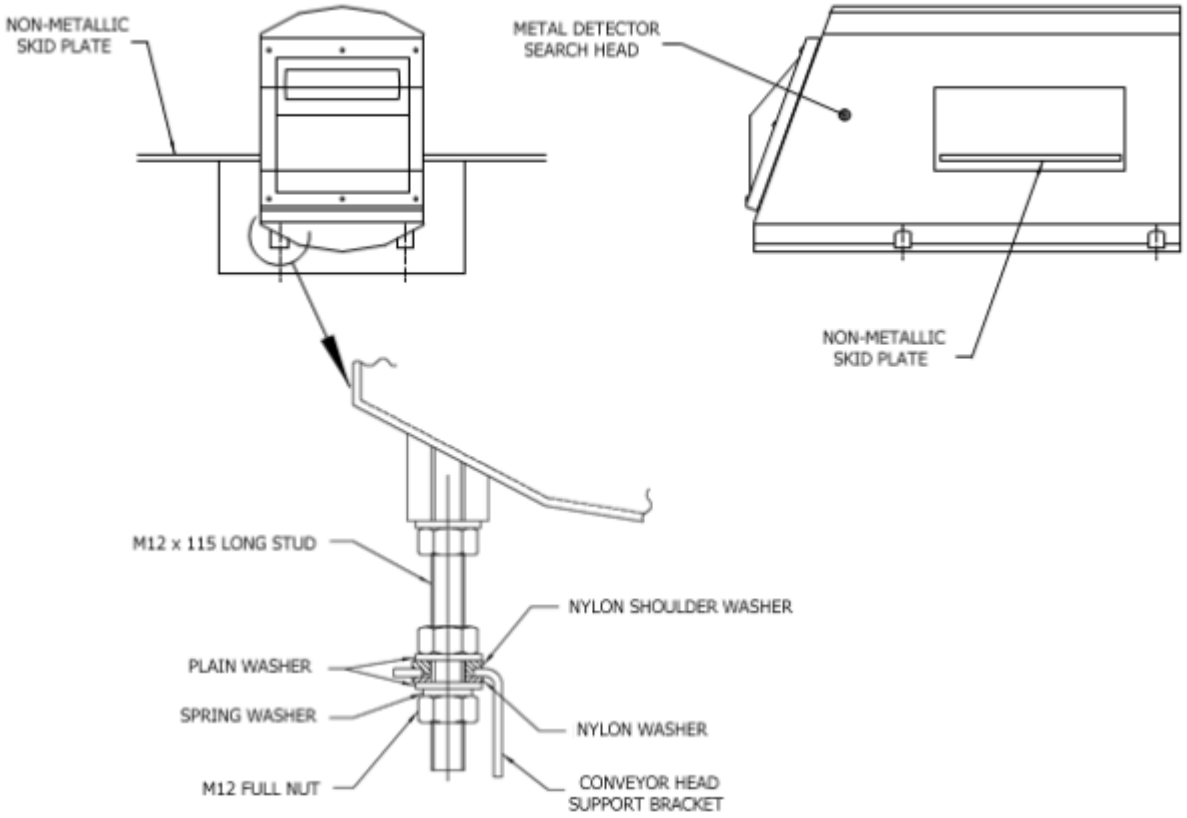
Using a Fork Lift

- Position the forks under the pallet and raise it sufficiently to clear of the ground and any obstacles.
- Carefully move the pallet to the required location.
- Lower the forks and withdraw them from the pallet.

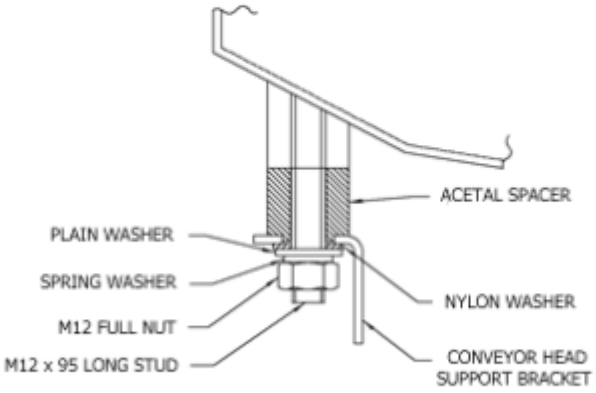
Detector Head Mounting Positions

This section contains standard mounting positions for Loma Metal Detector heads.

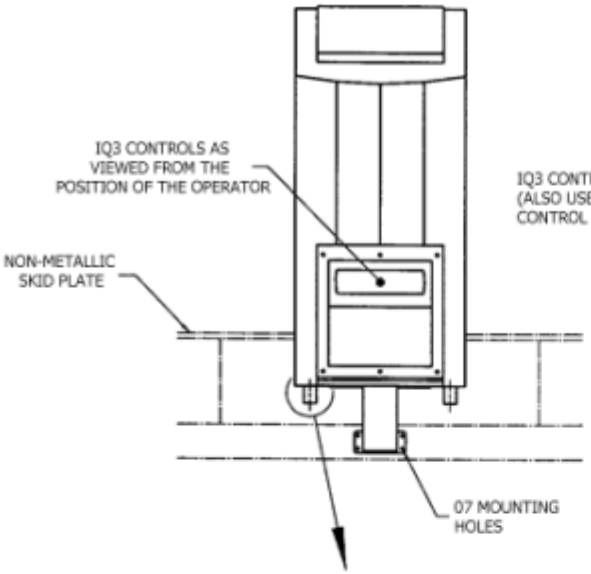
When refitting the head control panel cover, the cover fixing screws must be tightened to 4Nm torque to maintain the integrity of the IP69K rating for the head; preventing ingress of water or condensation.

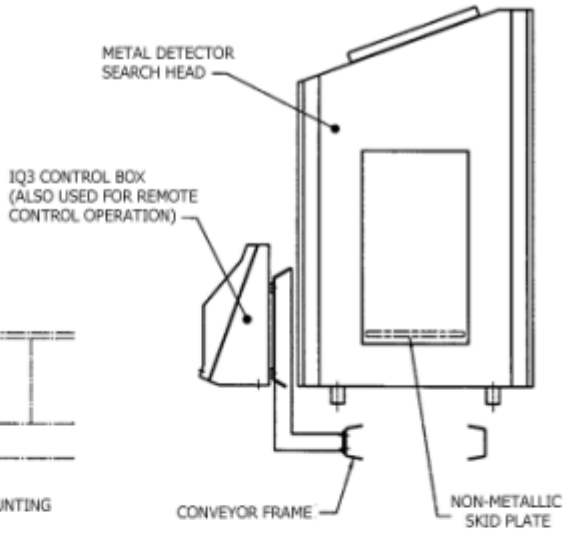


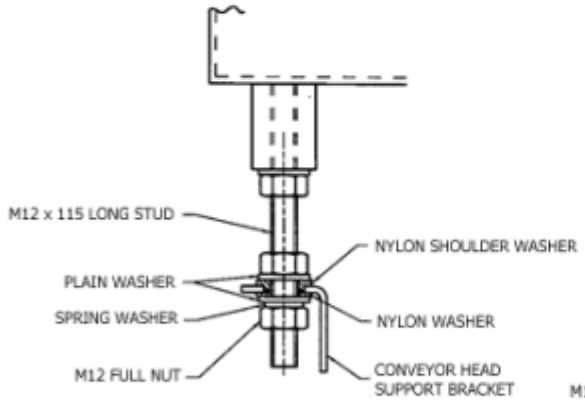
TYPICAL ADJUSTABLE MOUNTING ARRANGMENT
RECOMMENDED FOR APERTURE HEIGHTS UP TO 350mm

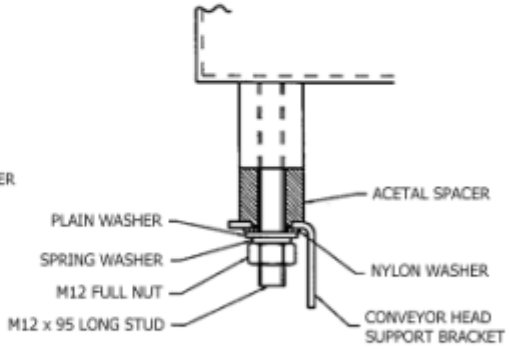


TYPICAL FIXED MOUNTING ARRANGMENT RECOMMENDED
FOR APERTURE HEIGHTS GREATER THAN 350mm




METAL DETECTOR SEARCH HEAD
IQ3 CONTROL BOX (ALSO USED FOR REMOTE CONTROL OPERATION)
CONVEYOR FRAME
NON-METALLIC SKID PLATE





TYPICAL ADJUSTABLE MOUNTING ARRANGEMENT RECOMMENDED FOR APERTURE WIDTHS UP TO 350mm

TYPICAL FIXED MOUNTING ARRANGEMENT RECOMMENDED FOR APERTURE WIDTHS GREATER THAN 350mm

NOTE:

THE COMMUNICATION CABLE BETWEEN THE METAL DETECTOR SEARCH HEAD AND IQ3 CONTROL BOX IS NOT TO EXCEED 2M IN LENGTH.

FOR REMOTE CONTROL OPTIONS WHERE THE CABLE LENGTH IS LIKELY TO EXCEED 2M A SEPARATE POWER SUPPLY UNIT IS SUPPLIED IN THE IQ3 CONTROL BOX.

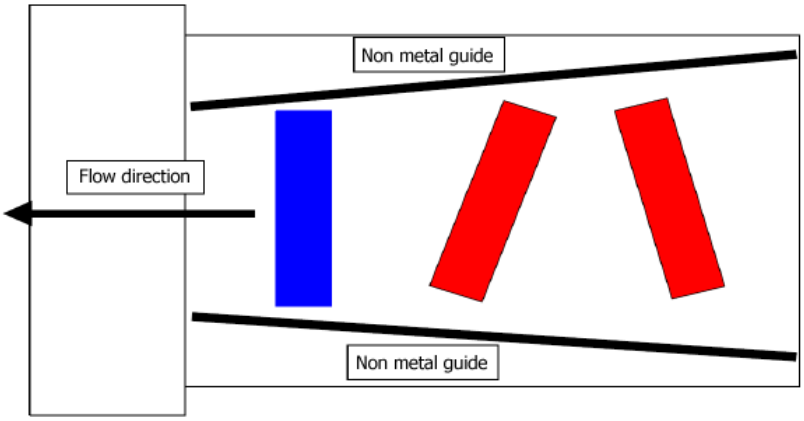
Mounting a Detector Head onto a Conveyor

Introduction

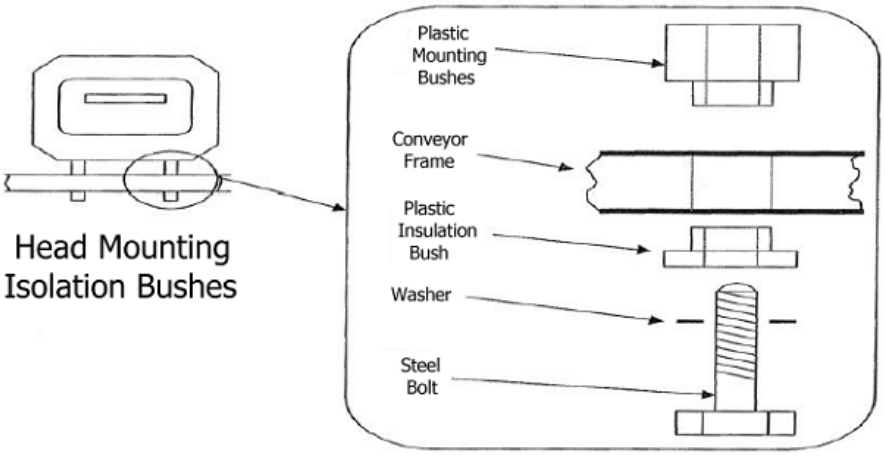
Loma Systems have been manufacturing metal detector systems for many years and our current conveyor design incorporates this wealth of experience. There are a number of integration rules that have to be followed when fitting a new detector head to an existing or third party conveyor to attain optimal performance and avoid nuisance triggering.

Basic Rules

1. The conveyor must be substantial and of welded ***not bolted*** construction.
2. The conveyor must have a means of height adjustment to level it to any infeed or outfeed conveyor systems and also to take out any unevenness of flooring. This is to provide conveyor stability.
3. No fixed metal is allowed nearer to the detector aperture than a distance of 1.5 times the smaller of the two aperture dimensions.
4. No moving metal is allowed nearer to the detector aperture than a distance of 3 times the smaller of the two aperture dimensions.
5. The detector head must be mounted on the conveyor using the supplied mounting kit.
6. The conveyor belt must be of a non metallic construction. The joint if applicable shall be heat sealed or vulcanised. Angled joints are preferred where possible, as are finger joints for thicker belts. Where modular belts are used, joining rods must be non metallic.
7. Rollers should be of a substantial construction to prevent bowing and crowned where applicable to help belt tracking on non modular belting.
8. Rollers can be PVC coated steel or aluminium or manufactured in a good quality stainless steel.
9. Rollers must be insulated from the main conveyor frame on at least one end to prevent the formation of eddy current loops as these can cause the detector to false trigger.
10. The conveyor belt must be supported through the detector aperture by a non metallic support such as a phenolic plastic or nylon strips. Whatever is used, it must be strong enough to support the intended product and not bow under the product weight.
11. Electrical interference: The reject relay usually switches inductive loads such as motor starter contactors and solenoid valves for air operated rejects. Its important that suitable suppressors are fitted to these devices.
12. Pack presentation: Consistent pack presentation is important to ensure optimal detection performance. Non Metal guides should be fitted to make sure that products do not randomly twist as they pass through the aperture. In the diagram below, where blue is good and red is bad, you can see that good guiding should present products correctly.



13. Head mechanical insulation: The head must be isolated from the conveyor metal work to reduce the transmission of vibration into the head. Isolation bushes must be fitted as shown in the diagram below



Reasoning Behind the Basic Rules

- **Nuisance triggering**

  Most problems with intermittent or nuisance triggering are due to insufficient appreciation of the basic rules of construction. For example: A bolted conveyor when brand new may appear to work perfectly well but over time bolts may work loose leading to nuisance triggering.

- **Conveyor construction**

  Where the product to be inspected is of a non conductive nature, such as powders or is hard frozen (<-18ºC / -0.4ºF) these can more than likely be run in the detectors DRY mode. In this mode it is inherently resistant to vibration/ shock

  Where the product to be inspected is wet and salty and of a conductive nature, such as fresh meats, cheeses, pickles and sauces the detector uses a different mode of operation because it has to eliminate the product effect. When operating in this mode, the detector's resistance to vibration and shock is not as good as when operating in DRY mode.

  Loma metal detectors are designed to minimise any vibration or shock effects when operating with conductive products. To further enhance this resistance the conveyor must be designed with consideration to the above rules.

  The detector is a radio frequency (RF) transmitter and receiver device that sets up an electromagnetic field in the head aperture. The stainless steel case acts as a screen to prevent external metal or electrical or magnetic fields, affecting the search coil assembly and to retain the field within the case.

  However because there is an opening (aperture) through which the product to be inspected must pass, some of this field radiates to the outside and, by induction, causes small electrical currents (eddy currents) to flow in nearby metallic structures that come within the effect of the field.

  If these structures form closed electrical circuits (loops), then these "closed" loops will form part of the detector conveyor framework. Provided that the eddy current paths have a constant electrical resistance, the detector will normally ignore them.

  Welding the framework of the conveyor ensures that most of the eddy current paths maintain a constant electrical resistance. It is impossible to guarantee this if the frame is bolted together – for example bolts can loosen slightly due to constant vibration or may not be fully tightened after general maintenance and bonding surfaces can corrode or be painted over, all of which will affect the resistance of a joint which can result in random false triggering.

  With rollers it is virtually impossible to provide a constant resistance path mainly because the bearings are usually lubricated by grease that is non conductive. The bearings act as contacts and in consequence the contact resistance varies as they move through the grease.

The alternative approach of permanently open circuiting the loop must be taken. This can be done by electrically insulating one end of the roller shaft from the frame of the conveyor. In practice it does not matter whether the eddy current path is open or short circuited, provided it can guarantee to be constant throughout the life of the conveyor, since problems arise only when the resistance of the path varies.

Be careful also when installing a conveyor, since large eddy current loops can be formed by service conduits used for routing electrical and compressed air supplies. Only bring down one electrical conduit since it has to be bonded to the conveyor frame for safety electrical earthing purposes.

Ensure that the compressed air supply pipe, if metallic, is insulated where it touches the detector or the conveyor frame at any point, or the electrical conduit in the region of the conveyor. It is always better to bring the final air connection on a flexible nylon tube. To prove the point one may like to try a simple experiment. Take a piece of wire and form it into a loop a little smaller than the detectors aperture. Do not at this stage connect the two ends together. It will be found that the open circuit loop can be brought quite close to the aperture without causing the detector to trigger. If the ends of the loop are intermittently closed then open circuited, it will be seen that the detector will trigger ate the instant of open or close circuiting, even if is at some distance away from the head aperture.

Mounting Horizontal Heads for Use with Conductive Products

Loma heads up to 350mm in height are supplied with an adjustable height mounting kit. The purpose of the height adjustment is to enable the centre line of the conductive product to pass through the “centre line” of the head aperture.

Conductive Products and Mounting Heads Vertically

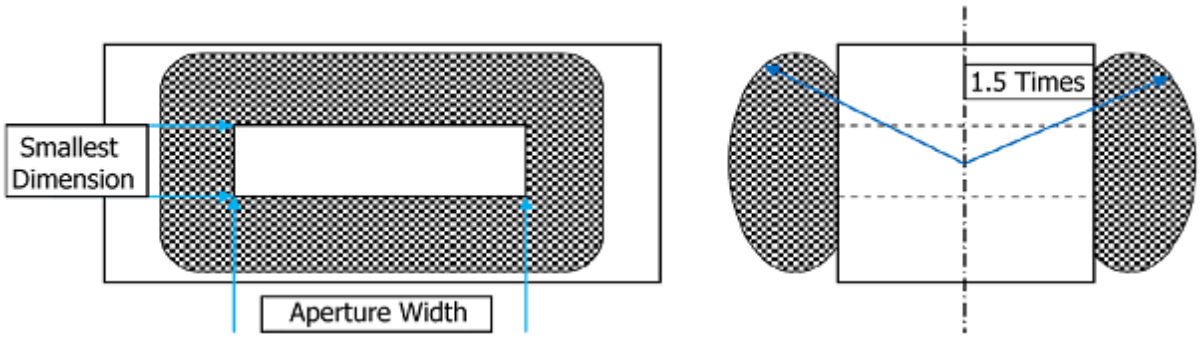
When mounting a metal detector head vertically, head the smallest dimension becomes the aperture width. The same rules apply as for centring a conductive product for a horizontal head. However the centre of the aperture now is in the vertical plane. For this set up, the product is centred using guides mounted on the conveyor, these channel the product centre through the aperture centre.

- **Fixed metal**

  Since the detector is efficiently screened, large masses of metal near the top, bottom or sides will not normally affect its performance. However metal that is nearer to the aperture than 1.5 times the smaller of the two aperture dimensions as measured from the centre of the case depth, can frequently be a major cause of poor performance, requiring the detector sensitivity to be reduced.

- **Moving Metal**

  Moving metal must be situated no nearer than 3 times the smaller aperture dimension from the detector as measured from the centre of the case depth



Moving metal excludes concentric rotating rollers. If they are concentric and can be guaranteed to stay that way, then they may be classed as fixed metal.

However it is important to reiterate that they must be insulated from the conveyor at one end or it is possible that they will cause false triggering by creating an intermittent eddy current path.

Other sources of moving metal can also include automatic reject devices, where the reject movement is detected or supply cables that are placed too close to the detectors aperture or not securely fixed down.

- **Vibration**

  It is important that the detector is not subjected to excessive vibration. The conveyor must be substantial and well supported (all feet/wheels should be touching the ground and locked) to keep the detector stable. Electrical services must be taken through flexible and not rigid conduit. Do not use the detector or control box as a convenient point to anchor any conduit or pipe work whatever, whether it be rigid or flexible. Do not use the detector or conveyor as a walkway or use the detector top to store items on.

- **Belting**

  Conveyor belts should be plastic or polyurethane. The belt joint is best angled, preferably at 60º, 90º. Joints are not preferred unless there is no other choice, joints must be vulcanised or heat sealed.

  Clipped or sewn joints are not acceptable as product could become trapped making the belt less hygienic or contamination could become trapped. This will affect the performance of the detector.

  Coloured belts sometimes contain oxide used as a colouring material. These are metallic in origin and therefore can be detectable resulting in either false triggering or a reduction in detector performance. Equally some belts have an antistatic coating that again can be detectable; this type of belt should be avoided.

  Care must be taken when fitting and joining belts to ensure that all metallic swarf and filings have been cleared away. If any drilling of the conveyor frame is required at any time then great care must be taken to avoid accidental contamination of the belt.

  Belt tracking systems should be easily adjustable. Crowned rollers can help tracking with non modular belt types. Always ensure that modular belt jointing pins are non-metallic.

- **Skid Plate**

  It is important that the belt does not touch the bottom or sides of the detector aperture. The belt must be supported through the aperture by a non-metallic material. Materials that can generate high levels of static charge from the continuous movement across the plate surface must be avoided. The material must be strong enough to support the weight of the product at all times. When fitted, the plate must not protrude above the level of the rollers. It is recommended to maintain at least a 10mm clearance between the undersides of the plate/belt to avoid contact with the bottom of the detector aperture.

- **Electrical Interference**

  The detector head operates at radio frequencies in the radio broadcast long wave spectrum. The detector has been designed with a high level of immunity to mains borne interference as well as airborne interference. If trouble is experienced, the interfering device/s should be located and the interference suppressed at source. However if this is not possible then the detector may have to be run at a reduced sensitivity.

  It is also advised not to operate two metal detectors in close proximity that operate at the same fundamental frequency as interaction is possible.

  To minimise this possibility two detectors interfering with each other, they should not be closer than a distance of not less than 16 times the smallest aperture dimension.

  The presence of large amounts of metal such as from other conveyors or support frames in the vicinity of the detectors may mean the distance will have to be larger.

  Other sources of airborne interference such as from speed controllers, radio paging devices, walkie-talkie radios and mobile telephones should not be operated in close proximity to the detector.

Post Installation Problems

- **Spurious Triggering**

  The Loma range of detectors is the product of many years experience and development. They are inherently reliable, provided that it is installed and set up correctly. Remember that the detector can detect can detect moving metal anywhere within its metal free zone. This is up to a distance of 3 times the smaller of the aperture dimensions away from the detector.

Connecting the Detector Head Electrical Supplies

Connection of an electrical supply to the metal detector head must only be carried out by suitably trained and qualified personnel.

The supply voltage for the search head is indicated on the identification/rating label that is etched on the back of the search head. Diagrams are included to provide details for connection of the head to a suitable electrical supply and also for connection of the head to reject mechanisms, warning alarms and other external devices.

The following guidelines should be observed:

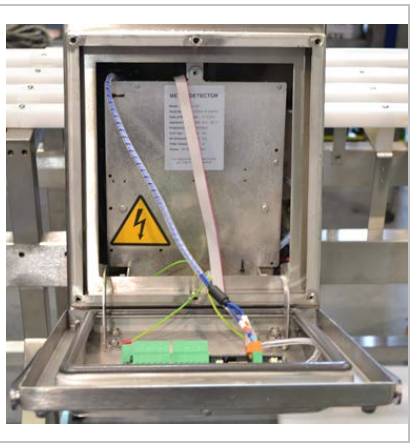
- The power source chosen should be clean and independent of any other equipment and have a good ground / earth connection.
- Power cabling must be rated at no less than 5A current carrying capability and be routed into the control box area through one of the four gland entry holes provided.
- Power cabling for a UL approved detector is 20 -16AWG fed from a locally positioned switch or power breaker that is within easy reach of the operator. The breaker must be labelled as the disconnecting device for the equipment. The cable tightening torque is 5.5in/lbs, routing into the control box area as described above.

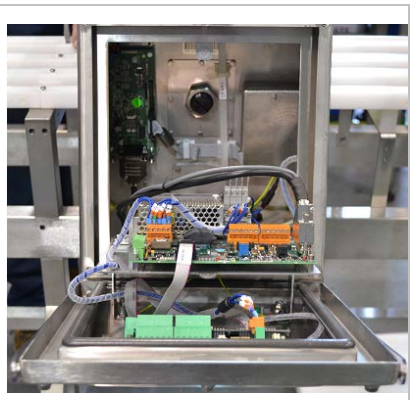
Do not use rigid conduit of any type. Rigid conduit can lead to vibration being transmitted to the head, resulting in spurious triggering.

When refitting the head control panel cover the cover fixing screws must be tightened to 4Nm torque to maintain the integrity of the IP69K rating for the head; preventing ingress of water or condensation.

The electrical supply is connected to the Mains Filter located inside the detector head front panel and then distributed around the head via a MEANWELL Power Supply.

To connect an electrical supply, proceed as follows:

1.	Remove the six front cover retaining bolts and drop down the cover until it is held against the supports	

2.	Remove the screw from the top of the metal cover plate and lower it down carefully	
3.	The Mains Filter is mounted inside the panel housing mounted on the right hand side. 	
4.	Push the mains cable up through one of the available cable glands. Then Split the cable inside the box and cut the wires to suitable lengths. An armoured/braided cable is recommended when cable conduit is not used. A suitable earth conductor is also to be fitted.	
5.	Crimp connectors onto the wires and connect to the Mains Filter as specified in the table below.	
6.	Check that all connections are secure then refit the metal cover plate and front cover.	

Ensure that the front panel cover fixing bolts have been tightened to 4Nm torque to maintain the integrity of the IP69K rating for the head; preventing ingress of water or condensation.

European	Colour	North America	Colour	Terminal
LIVE	Brown or Black	HOT	Black	L
NEUTRAL	Blue	NEUTRAL	White	N
EARTH	Green/Yellow	GROUND	Green	E
SCREEN	-	SCREEN	-	E

Do not use rigid conduit of any type. Rigid conduit can lead to vibration being transmitted to other components, resulting in spurious triggering / rejects.

Disconnecting the Power

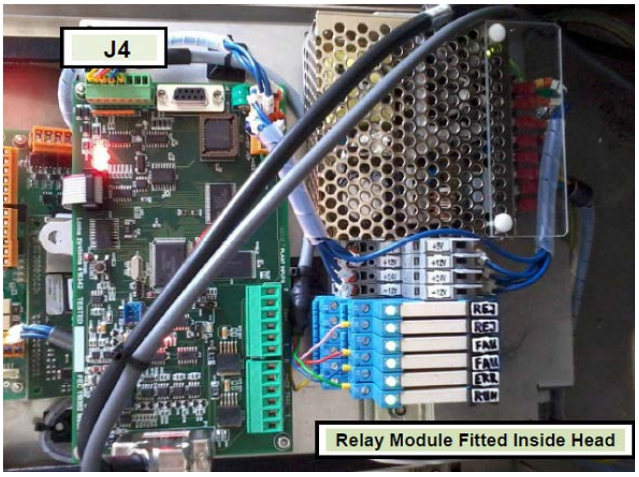
Before disconnecting the detector head from its power source, ensure that any signal cables connected to other equipment are disconnected first.

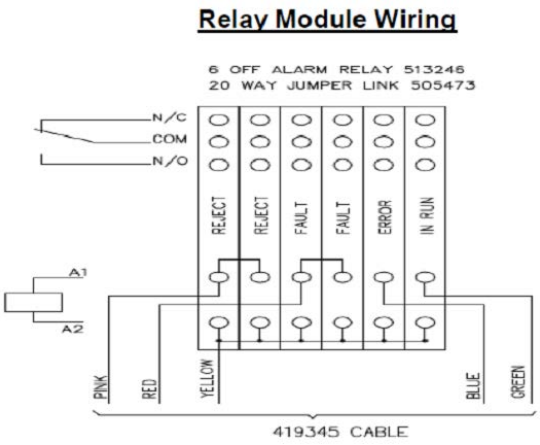
Input / Output Signal Information

To connect to external devices a Relay kit, Loma part number 6120PL500, consisting of a relay module, a cable that connects the relay module to the mini control board and some cable ties, can be supplied.

Please refer to Loma Drawing 5000/C3/C69405 – IQ^3+ Miniboard External Relays Block Diagram. A copy of the diagram is supplied with the detector head and can also be obtained by contacting your local Loma Service Centre.

You can fit the relay module into the head using the supplied connecting cable as shown in the picture below or alternatively you can also fit the Relay module into an external electrical box. This will require a longer connecting cable (2.6 m) which is available from Loma under part number 419343.





To power external sensors and PECs, jumper JP7 on the mini control board is used to set the output voltage provided by the mini control board to either 12V or 24V as required.

When the jumper is set to the VEXT position, 24V is provided on TBA2 – Pin 6.

When the jumper is set to the +12V (VP) position, 12V is provided on TBA1 – Pin 6.

For any sensors that require +12V please use pin 2 of J1 for the supply feed.

When using the internal power module to supply power to the sensors, a link wire (GND) **must** be fitted from **TBA1** pin **5** to connection **7** (COM) of the Power supply module.

If this link wire is not fitted and the internal power supply is being used to supply power to the inputs/ alarms/PEC they will not work as they will not be grounded.

Variable Speed Systems

On systems employing variable speed conveyors, special hardware is required to drive the CTB (conveyor time base) input on the micro control card. Conveyor systems supplied by Loma will already have this hardware fitted and commissioned, but when purchasing a detector head only, the following information should be observed when using a variable speed conveyor.

In order for the reject timing to work correctly, it must be supplied with information about how far the contaminant has travelled between the head and point of reject. This is achieved via a shaft encoder which supplies pulses to the CTB input of the micro control board.

The delay information, which is entered in the **Product setup** menu, then counts the CTB pulses out to time the contaminated product to the reject point. For this reason the delay is measured in distance, and should be set at the fastest conveyor speed in order for the reject device to actuate in time.

The dwell, on the other hand, should be set at the slowest belt speed to guarantee accurate rejection at all speeds. The dwell can be in units of time or distance depending upon the type of reject device.

Installing a Metal Detector System

This chapter provides generic information covering the installation of a Loma Metal Detector System in a logical sequence. The system includes a detector head fitted to a European conveyor belt.

The following sub-sections provide more information:

- **Warnings**

  A list of applicable safety warnings to be observed when installing the metal detector system is provided.

- **Receiving and Unpacking**

  Some basic checks should be carried out on receipt of the system to ensure that it has not been damaged in transit.

- **Moving the Machine**

  Depending on the size and weight of the system, either a crane or a fork-lift truck will be required to lift and move it into the final location. This section provides some guidance for moving the system safely.

- **Adjusting / Levelling the Conveyor**

  For systems supplied that incorporate a conveyor the operating height may need to be adjusted so that it can be integrated into your production line. This section provides some guidance for levelling the system.

- **Clearance Requirements**

  From safety and operational viewpoints, it is important that sufficient free space is left around the system, This section provides some guidance.

- **Connecting the Air Supply**

  Except where a metal detector head only has been supplied, all Loma inspection systems require a clean and dry compressed air supply where optional automatic reject devices are fitted. This section provides some guidance on connecting the air supply.

- **Connecting the Electrical Supplies**

  The system should have its own dedicated electrical supply, unless the line supply is known to be clean. The earth should be robust, of low impedance and noise free. This section provides some guidance on connecting an electrical supply.

- **Checking Guards**

  The system should have its own dedicated electrical supply, unless the line supply is known to be clean. The earth should be robust, of low impedance and noise free. This section provides some guidance on connecting an electrical supply.

- **Checking Belt Tracking**

  The system should have its own dedicated electrical supply, unless the line supply is known to be clean. The earth should be robust, of low impedance and noise free. This section provides some guidance on connecting an electrical supply.

- **Setting Up Reject Mechanisms**

  The conveyor system is supplied with the reject mechanism correctly set up. Normally no further adjustment should be required.

- **Remote User Interface**

  The electronic controls for the metal detector are integrated into the search head along with the user interface, but the user interface can be mounted remotely in it's own housing where access would otherwise be difficult.

- **Installing a Serial Link**

  In order to use any of the serial link options your detector will require a cable and connector assembly which facilitates external connection to the on board serial link electronics.

Warnings

The following safety warnings apply when installing an IQ^3 Metal Detector head:

1. LETHAL HAZARD – ELECTRICAL SUPPLIES
2. LETHAL HAZARD – COMPRESSED AIR SUPPLIES
3. NON-IONIZING RADIATION
4. WORKING ON EQUIPMENT
5. REJECT DEVICES
6. EXCESSIVE NOISE
7. HEAVY EQUIPMENT
8. LIFTING THE MACHINE
9. MOVING THE MACHINE
10. CONTAMINANTS

For details see the Safety Warnings section.

The following emergency procedures apply to these procedures:

2. DEALING WITH FIRE.

For details see the Emergency Procedures section.

Receiving and Unpacking

Receiving the machine

- On receipt of your Loma inspection machine, we recommend that you check the external packing for any signs of damage.
- If the external packaging is damaged do not refuse the shipment but make a notation on the carriers delivery receipt and take pictures of the packaging damage.
- When moving the machine, please follow the guidance included in the Moving the Machine section.

Unpacking the machine

- Remove all packing and retain in case the machine has to be repacked for return.
- If on unpacking the machine it is subsequently found to be damaged, take further pictures of the damage and send them to Loma Systems. Loma Systems will then carry out an investigation, including a review of the applicable carriage terms / Incoterms, to decide what action is to be taken.

- Wheels (if fitted) are screwed fully in and are locked (UK only), or supplied in a polythene bag which is placed inside the reject bin (Europe). Remove them from the reject bin and remove the packing material. Then fit the wheels to the out rigged legs of the machine frame. You may need to raise the machine to fit the wheels so please follow the guidance included in the Moving the Machine section.
- Feet may have been fitted for transit purposes or 20 mm bolts may be used to secure the machine to a pallet. Conveyors for customers in Europe may have been secured to the pallet by 20 mm bolts which are screwed into the underside of the legs. Remove these bolts if fitted. You may need to raise the machine to remove the transit bolts and fit the feet so please follow the guidance included in the Moving the Machine section.

Removing Bolts and Fitting Wheels

- Conveyors for customers in Europe may have been secured to the pallet by 20 mm bolts which are screwed into the underside of the legs. Remove these bolts if fitted
- If wheels have been supplied for the conveyor, remove them from the reject bin and remove the packing material. Fit the wheels to the outrigged legs of the conveyor. This is best done when the system has been raised up to take the weight off of the legs and allow room to screw in the wheels.

Moving the Machine

Depending on the size and weight of the machine, either a crane or a fork-lift truck will be required to lift and move it into the final location.

When a machine fitted with wheels is to be pushed on the wheels, it is important that it is moved carefully. Avoid hitting obstacles with the wheels as this can damage the plastic wheel inserts inside the legs.

Using a Crane

- Position the straps under the frame and around the machine so that it will not tilt when lifted. Then attach the straps to the crane.
- Lift the machine carefully and move it to the required location.
- Lower the machine and remove the straps.
- Do not attempt to lift or move a machine by a reject cover as they are easily damaged.

Using a Fork Lift Truck

- A machine tends to be top heavy so may topple forwards when lifted. For this reason it is advised that the machine is positioned on the forks with the front of the machine facing backwards.
- Raise the forks sufficiently to lift the machine clear of the ground and any obstacles.
- Carefully move the machine to the required location. Then lLower the forks and withdraw them from the machine.

Adjusting / Levelling the Conveyor

For systems supplied that incorporate one or a number of conveyors the operating height may need to be adjusted so that it can be integrated into your production line.

- Adjust the infeed and outfeed heights as necessary by means of either the adjustable feet or adjustable wheels. Then lock the wheels (if fitted).
- Ensure that all feet or wheels are firmly on the ground, and are evenly supporting the conveyor so that it does not rock.
- If necessary, anchor the conveyor to the ground using bolts screwed into the feet.
- Do not fasten the conveyor to any other piece of machinery as this could lead to vibration being transmitted to other parts of the machine, resulting in spurious triggering / rejects.

- If the conveyor is fitted with feet, you are recommended to apply silicone sealant around the feet and floor.

Clearance Requirements

From safety and operational viewpoints, it is important that sufficient free space is left around the machine, specifically the front and back, to enable commissioning and for maintenance personnel to easily gain access to components.

It is recommended that wherever possible a minimum of 1 metre free space is available at the front of the machine and 1 metre at the rear.

Connecting the Air Supply

Do not start the machine and initiate the use of any compressed air before the Loma commissioning engineer has approved the installation.

Except where a metal detector head only is being supplied, all Loma metal detector systems require a clean and dry compressed air supply, primarily to operate the optional automatic reject system.

It is therefore essential that the air supply is robust enough for correct operation of the system when the reject operates.

- **Pneumatic Assembly** – The pneumatic system consists of the following components:
  - **Isolator Switch** – The external air supply is connected to the switch which is used to turn the supply to the system on and off. The air supply is then fed into the Air Regulator.

The Isolator Switch can be locked in the 'OFF' position using a padlock to prevent accidental operation whilst carrying out servicing and maintenance activities.

  - **Air Regulator** – The air regulator is used to set the air pressure being supplied to the system. A drain trap is provided to remove any water that collects in the system. See the Maintenance section for further details. The air supply is then fed into the Dump Valve.
  - **Dump Valve** – The dump valve is a safety device that dumps air pressure from the system in an emergency to protect the operator. It also includes a soft start feature which allows air pressure to build slowly following an air pressure dump to prevent damage or injury. The air supply is fed from the valve to the input connection on the Reject Valve.

- **Reject Valve** – The Reject Valve is attached to the pneumatic assembly and contains five ports as follows:
  - **Air Supply Input Port** – The air supply from the dump valve is connected to the input.
  - **Air Supply Output Port 1** – The air supply is fed to one side of a reject device. For example when fitted to one side of a double acting air cylinder, the air drives a rod attached to a nylon blade to push product off a conveyor into a reject bin.
  - **Air Supply Output Port 2** - The air supply is fed to the other side of a reject device. For example when fitted to the other side of a double acting air cylinder, the air drives a rod attached to a nylon blade back to its start position.
  - **Air Supply Dump Output Port 1** – When an emergency stop is activated, the air pressure captured in one side of the reject device is dumped through this port. A suppressor is fitted to the port to reduce any noise generated.
  - **Air Supply Dump Output Port 2** – When an emergency stop is activated, the air pressure captured in the other side of the reject device is dumped through this port. A suppressor is fitted to the port to reduce any noise generated

In addition for fail-safe reasons an air pressure switch is fitted in order to alert the operator that the air supply is low (below 40psi / 2.8 bar) and to shut down the system; generating a fault condition.

The system will be supplied with the pneumatic system already fitted and connected to the applicable reject device.

Therefore the only actions required are to connect the air supply to the input side of the air regulator using 10mm O/D tubing and set the air pressure using the regulator.

The air pressure should be set to 80psi (5.5 bar) except when being used to supply an air-blast reject device when the pressure should be set to 100psi (6.9 bar). The minimum air pressure must not fall below 65psi (4.5 bar) when the reject operates.

Care should be taken when cutting the compressed air supply tube to length before fitting to ensure that no particles enter the tube as this may cause damage to or prevent the high precision air nozzles from operating correctly.

Connecting the Electrical Supplies

Connection of the machine to an electrical supply must only be carried out by suitably trained and qualified personnel.

The supply voltage for the machine is indicated on the identification/rating plate that is mounted on the frame. An electrical diagram is supplied with each machine to provide connection details.

The machine should have its own dedicated supply, unless the line supply is known to be clean. The earth should be robust, of low impedance and noise free.

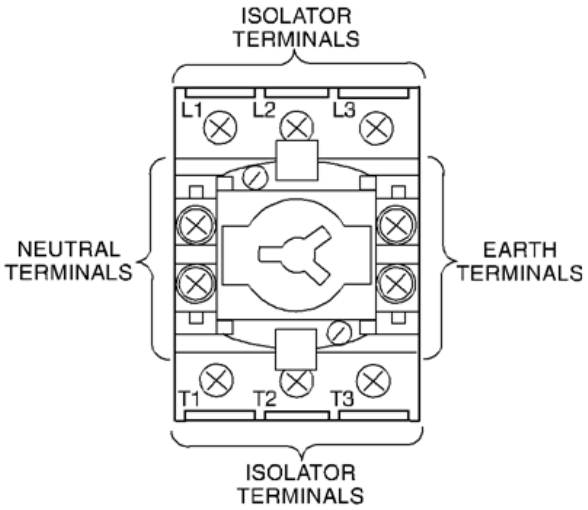
Any dedicated supply line should be run in its own conduit / trunking away from other noisy supplies. The input voltage should not be subject to voltage fluctuations outside the limits (NWML0320):

- Minus 15% to plus 10% of the nominal supply voltage (230V or 110V).
- Zero voltage for more than 20mS.
- 50% of nominal voltage for more than 40mS.
- 80% of nominal voltage for more than 100mS.

Operation outside these limits may cause loss of function until the supply condition recovers to within limits.

The standard metal detector conveyor is fitted with a starter isolator and a 24V ac control circuit. The supply voltage for the conveyor is indicated on the identification plate that is mounted on the frame.

The following illustration shows the isolator inside a typical electrical services box



The Isolator Switch can be locked in the 'OFF' position using a padlock to prevent electrical power being restored whilst carrying out servicing and maintenance activities.

To connect an electrical supply, proceed as follows:

1.	Unlock and open the Electrical Services Box to access the electrical services.
2.	The back of the Isolator Switch is located in the bottom right hand side of the cabinet when viewed from the rear. Beneath it on the bottom of the cabinet is the cable gland access for the power cable.
3.	Push the supply cable up into the Electrical Services Box through the cable gland.
4.	Split the cable inside the box and cut the wires to suitable lengths. An armoured/braided cable is recommended when cable conduit is not used. A suitable earth conductor is also to be fitted.
5.	Crimp connectors onto the wires and connect to the Isolator Switch as specified in the table below.
6.	Check that all connections are secure then refit the metal cover plate and front cover.

The supply to the conveyor must be either 5-core cable (3-core cable is suitable for single phase machines) fed through a flexible conduit or 5-core armoured cable . Insert the cable through the gland.

Do not use rigid conduit of any type. Rigid conduit can lead to vibration being transmitted to other components, resulting in spurious triggering / rejects.

Cable Connections

3-Phase, Earth and Neutral	
Core	**Terminal**
3-phases	L1, L2 and L3
Neutral	N
Earth	E
3-Phase, Earth, No Neutral	
Core	**Terminal**
3-phases	L1, L2 and L3
Neutral	Not used
Earth	E
1-Phase, Earth and Neutral	
Core	**Terminal**
1-phase	L1
Neutral	N
Earth	E

Do not start the machine and initiate the use of any electrical circuitry before the Loma commissioning engineer has approved the installation.

Checking Guards

- Check that all guards are securely fastened in place.
- On some conveyors that are made to special order, hatches may be fitted to permit access to some areas of the machine. These hatches are generally fitted with electrical interlocks which prevent the machine from operating whilst a hatch is open. Check that all hatches are closed.
- Check that the infeed and outfeed areas of the conveyor are clear of obstructions.

Checking Belt Tracking (PV belt system only)

The belt must be checked for correct tracking before running the conveyor for any length of time. If belt tracking needs to be reset. See Conveyor Belt Maintenance for further details.

Setting Up Reject Mechanisms

The conveyor system is supplied with the reject mechanism correctly set up. Normally, no further adjustment should be required. If adjustment is required see Adjusting the Reject Mechanisms for further details.

If the reject Delay and Dwell times need to be adjusted, these are set up via the user interface from the control panel. See Adding a New Product Adding a New Product for further details.

Remote User Interface

The electronic controls for the metal detector are integrated into the search head along with the user interface, but the user interface can be mounted remotely in it‘s own housing where access would otherwise be difficult.

Two versions of remote user interface are available, one with an on-board power supply and one without. The model with the on-board power supply must be used where the cabling between the search head and user interface exceeds two metres in length.

Care must be taken when routing the cabling to the remote user interface to observe good EMC practice – do not run with mains or high energy switching cables.

Installing a Serial Link

The main control electronics board must have the optional serial link board fitted.

In order to use any of the serial link options your detector will require a cable and connector assembly which facilitates external connection to the on board serial link electronics. The connector is normally located on the underside of the control box.

If a serial link option was ordered with your detector the necessary internal cables and external socket complete with a blank mating external plug and connection diagrams will be supplied. If you wish to add a serial link to an existing system please contact your local Service Centre who will be pleased to assist. See the Setting Up Serial Links Setting Up Serial Links section for further details.

Site Considerations

Electromagnetic Compatibility (EMC)

All Loma machines are designed, and tested, to operate under factory conditions and have been tested to recognised international standards for Electromagnetic Compatibility (EMC), both in terms of not emitting excessively and not being subject to undesirable operation in the presence of other equipment whose emissions also meet the standards.

This approach allows Loma to offer stable operation, even in RF noisy environments, provided the other equipment is to the same standards and the field wiring is suitably ‘hard’.

It is still necessary, however, to ensure that the machine is not subjected to excessive electrical noise via its supply or airborne sources.

Selection of Frequency Band

If two or more metal detectors sited within the same area are operating at the same frequency, then they will interfere with each other leading to false rejects and unstable operation.

To overcome this problem, the detectors can be set to operate on one of ten different bands through the ***Menus > Service > Configuration > Head*** menu Search Head Setup screen. It is therefore very important to ensure that detectors operating near one another are set to operate at different bands. See Frequency Selection Frequency Selection for further details.

Other EMC considerations

Any signal I/O which is connected to the auxiliary connections should be in screened cable, grounded at one end by a low impedance path to RF, and kept free from sources of electrical noise (e.g. mains supplies for large electrical machines).

The metal detector is a highly sensitive RF measuring device, which is well screened from outside interference and has excellent electronic discrimination against unwanted electromagnetic fields. However, due to its sensitivity it is possible that other devices which emit high levels of RF noise at the operating frequency of the detector could cause interference, thereby degrading the performance of the detector.

It is therefore important to avoid siting the detector next to any devices which emit abnormally high levels of RF interference if proper operation is to be maintained.

Radio Frequency Interference

A metal detector is, essentially, a Radio Frequency (RF) transmitter and receiver. As such it is sensitive to RF noise in the general vicinity of the detector location. Whilst those frequencies not close to the operating frequency of the detector will usually be filtered out (this includes most ‘walkie talkie’ frequencies, unless the transmitter is held very close to the detector aperture), it is not uncommon for the control frequency (or multiple of it), used in modern speed controllers, to cause interference.

To reduce the risks of such interference causing false rejects or other symptoms of undesirable operation at the metal detector, the following recommendations should be followed:

- Always route speed controller input and output wiring away from the metal detector area. NEVER put speed controller wiring in the same conduit or on the same supply as the metal detector wiring.
- Run speed controller wiring in the general vicinity of the metal detector in a rigid steel conduit or use other techniques to ensure 100% screening of the cable.
- Always follow the speed controller manufacturer’s instructions for installation, wiring, screening and grounding.

In addition to following these guidelines, most speed controller manufacturers supply input and output filters which can be fitted to the field wiring to dramatically reduce RF emissions if necessary.

All Loma metal detectors are designed, and tested, to meet the requirements of the FCC and the new stringent European regulations for RF emissions, both in terms of not emitting excessively and not being subject to undesirable operation in the presence of other equipment whose emissions also meet the standards.

This approach allows Loma to offer stable operation even in RF noisy environments, provided the other equipment is to the same standards and the field wiring is suitable ‘hard’.

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About the Metal Detector Range

Introduction

Loma's metal detectors are packed with some incredible patented innovations, which are all designed to make them compliant with current legislation and best in class.

Even more robust and reliable, the latest products continue to lead the way in tackling key industry challenges and standards, notably food inspection Codes of Practice and user traceability. Its breakthrough innovations, including a new touch screen display, can be easily retrofitted to older product versions on request.

The search head is available separately for fitting to your own conveyor or this can be supplied as a system, already fitted to a Loma conveyor. A Pipeline Metal Detector is also included in the range for inspecting pumped products.

The items numbered in the figure are listed and described below.

- 1 - Metal Detector Search Heads
- 2 - Conveyor Belts
- 3 - Reject Devices
- 4 - Electrical Services Box
- 5 - LED Lamp Stack
- 6 - Product Guides
- 7 - Guards

Metal Detector Search Heads

To cater for the requirements of different types of product the IQ^3 Metal Detector Search Head is available in a range of aperture heights and widths to suit the product to be inspected.

Standard Features

- **Variable Frequency Capability** - Loma is the only company in the industry that offers true variable frequency, operating between 40 - 900 kHz. This means that you can configure the same machine for use with a variety of products. Through the systems product 'Learn' feature, the correct frequency for a product can be automatically set in seconds, eliminating past performance restrictions caused by limited frequency metal detectors.
- **Two-Line Display** - The control panel is fitted with a two line display user interface in conjunction with a number of buttons that provide full access to the head detector features and allow the setup and calibration of the system through a menu-driven user interface. The user interface can be mounted remotely as an option.
- **Touch Screen** – The control panel is fitted with a 5.7“ LED touch screen to provide full access to the head detector features and allow the setup and calibration of the system through a menu-driven user interface. The user interface can be mounted remotely as an option.
- **USB Connector Socket** – A USB connector socket is fitted on the right hand side of the control panel. A USB memory stick can be used to download reports and logs from the system. It can also be used when upgrading the system software version

The USB connector socket is fitted with a waterproof cover. This must be replaced after use to maintain the waterproof rating of the machine. Failure to replace the cover properly may result in water damage to your machine and will invalidate the warranty.

- **Environmental Protection Cover** – A plastic cover, mounted on hinges, is provided to go over the touch screen to prevent the screen being damaged during cleaning operations.

Optional Features

The following optional features are supplied with a detector search head:

- **Harsh Environment Protection Liner** – This white aperture liner is made from POM C Acetyl Copolymer and is suitable for harsh applications where the product temeprature is > 30 degrees or if hose down or steam cleaning is to be used.
- **Remote Control Kit** - The remote controls is provided with a fully enclosed IQ^3+ control box, a mounting kit and bracket to mount on a frame/structure with up to 10-meter cable. Remote

boxes above a 2 metre distance from the search head have a local power supply unit fitted to run the touch screen display. A local mains power supply is required for the control box.

- **Lamp Stack** – A plastic LED lamp stack with audible alarm included (several sound alarm available and volume adjustable) is available. The lamp base is mounted on a pole on the side of the head and provides visual signalling as follows:
  - **Red Lamp** – System Error.
  - **Orange Lamp** – Detection / Rejection.
  - **Green Lamp** – Normal Running / Inspection.
  - **Blue Lamp** – Run Error / PVS Test.
- **Communication Packages** – The search head is compatible with the following communication packages:
  - **LomaEnet** (serial link board required) – The LomaEnet Capture application provides the facility to distribute copies of reports generated by the metal detector to other suitable devices that are on the same computer network as the metal detector. This allows personnel to analyse and archive data.
  - **LomaLink** (serial link board required) - A serial connection is used to communicate with the metal detector using a remote PC.
  - **Ethernet** (serial link & ethernet boards required).
  - **LomaOPC** (serial link & ethernet boards required) – The LomaOPC application is installed onto a remote PC and a serial connection established to pass data using OPC tags.

The search head can be fitted with a number of external sensors; an optional sensor board is required for this.

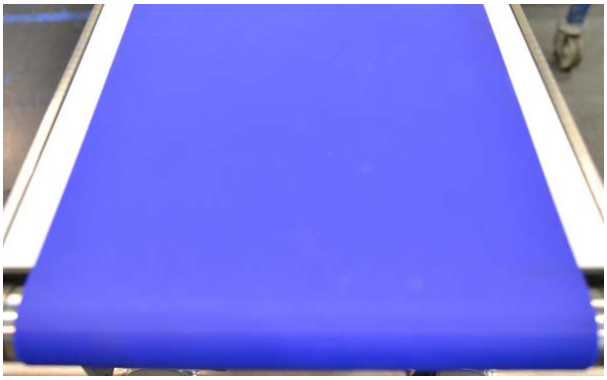
Conveyor Belts

Loma conveyors are fitted with either flat belts which are suitable for use with lighter products or plastic modular belts which are suitable for use with heavier products in a harsher environment.

The belts are positively driven from a central drive sprocket that is secured on a square-section drive shaft. This means that no slippage and no deviation in tracking can occur.

Flat Belts

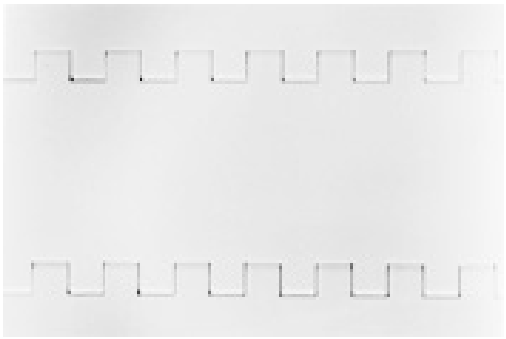
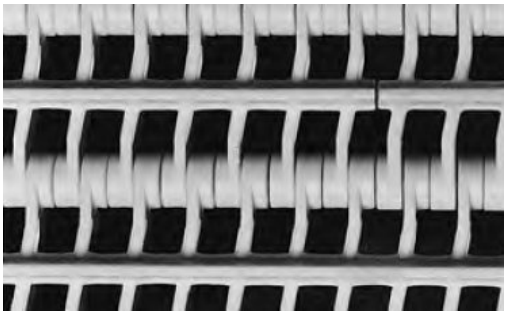
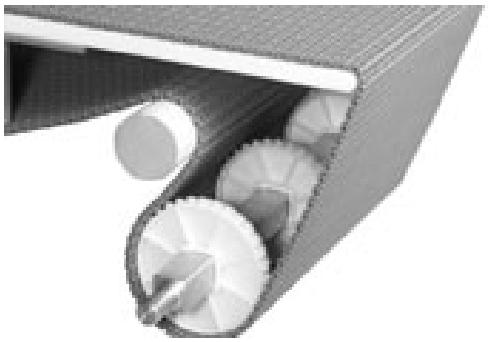
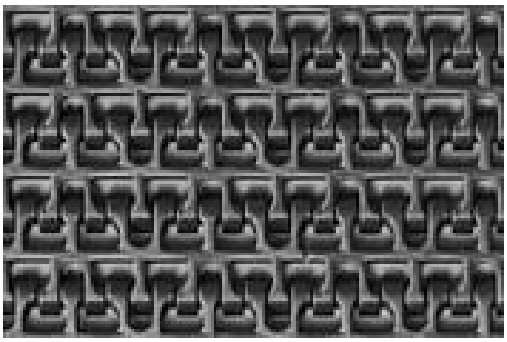
Flat belts are constructed from polyurethane and have a smooth surface. They are supplied as standard in white but blue coloured belts are available if required.



Plastic Modular Belts

The plastic modular belt conveyors use a belt constructed from injected-moulded plastic modules, assembled into an interlocked unit and joined by plastic hinge rods.

The following table gives details of the three different plastic modular belt types supplied by Loma:

Belt Type	Design	Applications
Flat top	Smooth closed surface	Wrapped or loose products
		
Flush grid	Open grid pattern with a smooth surface	Boxed or wrapped products
		
Lightweight flush grid	Open grid pattern with a smooth surface	Boxed or wrapped products
		

Reject Devices

Reject Devices

Loma Systems offer a range of reject devices for removing contaminated products from your production line, based on a number of factors including the product type, its general dimensions, the general set up of your production line and of course how you wish to handle contaminated products.

The following reject devices are available and may be fitted to your machine:

- **Stop On Detect (SOD)**

  The Stop-On-Detect reject device causes the conveyor to stop moving and an alarm to sound, indicating that a contaminant has been detected.

- **Air Blast**

  The air blast reject device uses a high pressure blast of compressed air to push a contaminated product off the belt into the reject bin.

- **Pusher**

  The pusher reject device pushes the contaminated product off the belt into the reject bin.

- **Plough**

  The plough reject device swings across the belt to divert the contaminated product off the belt into the reject bin.

- **Retracting Band**

  The retracting band reject device uses compressed air to activate a carriage retracting mechanism to create a gap in the conveyor belt. The contaminated product then falls through the gap and into a reject bin, which is mounted on the underside of the conveyor.

- **Powered Decliner**

  The powered decliner reject device uses compressed air to activate a carriage declining mechanism which guides the contaminated product into a reject bin mounted on the underside of the conveyor. The carriage then returns to its original position,

- **Signal Only**

  Alternatively, a conveyor can be supplied without a reject device but with ‘Signal Only’ output.

  On detection of metallic contaminant in the product, the control unit provides an output signal only. This conveyor can be used in conjunction with the customer’s choice of equipment.

As standard, a reject cover is fitted over the outfeed part of the belt and the reject device. This protective device is intended to stop any part of a person’s body from being placed within the operating area of the reject device. The Stop-On-Detect reject is not fitted with a reject cover.

Stop On Detect

Stop On Detect is the simplest type of reject device available which is most suitable for removing heavy, awkward shaped and continuous strip contaminated products from your production line.

When a contaminated product is detected the conveyor belt will stop and an alarm will sound, allowing you to remove the product from the conveyor belt and dispose of it in accordance with your local procedures.

After removal of the contaminated product, you must then manually restart the conveyor.

Stop On Detect reject device are suitable for use with systems where a maximum of 60 packs are being presented for inspection per minute and the maximum individual pack weight is 60Kg.

Air Blast

The Air Blast reject device is suitable for removing contaminated wrapped products from your production line using a high pressure blast of compressed air to push the contaminated product off of the conveyor belt and into a reject bin.

Generally a single nozzle is specified but a second nozzle can be fitted when required to provide more control or to reject over or underweight packs into a separate reject bin where the metal detector is being used in combination with a checkweigher.

Air Blast reject devices are suitable for use with systems where a maximum of 250 packs are being presented for inspection per minute and the maximum individual pack weight is 500g.

Pusher

The Pusher reject device is suitable for removing contaminated wrapped products in rigid packaging from your production line.

An acetyl blade, driven by a blast of high pressure compressed air, pushes the contaminated product off of the conveyor belt and into a reject bin.

Generally the pusher blade pushes the product off of the conveyor belt from the side, but an overhead pusher can be fitted when required to suit the product or production line set up.

Pusher reject devices are suitable for use with systems where a maximum of 100 packs are being presented for inspection per minute and the maximum individual pack weight is 10Kg. However, a heavy duty pusher is available which can be used for pack weights up to 50Kg. A reject roller track, rather than a reject bin, is recommended for use with a heavy duty pusher to remove the product safely from your production line.

Plough

The Plough reject device, sometimes referred to as the diverter, is suitable for removing cylindrical products being presented at a low rate from your production line.

An acetyl blade, driven by a blast of high pressure compressed air, moves across the conveyor belt to divert the contaminated product off of the conveyor belt and into a reject bin.

Plough reject devices are suitable for use with systems where a maximum of 60 packs are being presented for inspection per minute and the maximum individual pack weight is 1Kg.

Retracting Band

The retracting band reject device is suitable for removing continuous loose products such as polythene bags and sachets from your production line.

The device uses compressed air to activate a carriage retracting mechanism to create a gap in the conveyor belt. The contaminated product then falls through the gap and into a reject bin, which is mounted on the underside of the conveyor.

Retracting band reject devices are suitable for use with systems where a maximum of 100 packs are being presented for inspection per minute and the maximum individual pack weight is 5Kg. However, multiple lanes may be employed to increase the overall number of packs that are presented for inspection per minute.

Powered Decliner

The Powered Decliner reject device uses compressed air to activate a carriage decliner mechanism to lower part of the conveyor belt and direct the contaminated product into a reject bin or run off area.

The carriage is then raised back up to its normal position.

Signal Only

Alternatively, a conveyor can be supplied without a reject device but with ‘Signal Only’ output. On detection of metallic contaminant in the product, the control unit provides an output signal only. This conveyor can be used in conjunction with the customer’s choice of equipment.

Reject Bins

Two sizes of reject bin are available for collecting contaminated products removed from the conveyor belt using a pneumatic reject device. The size of the bin required is determined by the conveyor length and the size and weight of the product to be rejected.

Reject bins are fitted with a lockable door as standard and optionally with an electronically operated door lock mechanism that may be opened and locked by operators with a specific user level access account through the user interface.

In addition the bin can optionally be fitted with a 'Bin Full' photo-eye which generates a warning when the bin needs to be emptied. This option is enabled in the ***Menus > Service > Reject > Set Up*** menu A 'test' paddle can also be fitted to manually check that the Bin Full photo-eye is working correctly.

Electrical Services Box

Electrical supplies to the conveyor are connected inside the electrical services box. The box is generally mounted at the front of the conveyor frame but can be overhead mounted. Supplies are connected via the Isolator Switch. The internal components may be mounted on a printed circuit board or on din rails if a PLC version is supplied.

The door of the box is fitted with the Isolator Switch, Conveyor ‘Stop’ and ‘Start’ buttons and the Emergency ‘Stop’ button as described in the table below.

	The **Isolator Switch** is located on the front of the Electrical Services Box and is shown here in the **ON** position. Power is being supplied to the machine.
	The **Isolator Switch** is shown here in the **OFF** position. Power is NOT being supplied to the machine.
	The conveyor **Start/Sto**p button is located on the front of the Electrical Services Box and is used to start and stop the conveyor. Pushing the green section at the top of the button starts the conveyor and the white LED located in the middle of the button is lit to indicate this. Pushing the red section at the bottom of the button stops the conveyor and the white LED is extinguished.
	The **Emergency Stop** button is located on the front of the Electrical Services Box and is to be used in EMERGENCIES ONLY to stop the machine.

Guards

For Loma metal detectors the use of guarding, including covers, panels, curtains and other methods is extremely important in order to restrict operators from accessing contaminated products and also areas of the detector that are potentially hazardous.

Air Pressure Switch

An air pressure failure switch is fitted if the conveyor is supplied with either a pusher reject or a retracting band reject.

The switch is set by Loma to operate if the pressure of the compressed air supply to the reject falls below 40psi (2.8 bar). The conveyor then stops.

Optional Equipment

The following options are available, depending on the type of reject mechanism fitted:

Option	Stop On Detect	Air Blast	Pusher	Retracting Band
Audible Alarm	S	O	O	O
'Bin Full' Photo-eye	-	O	O	O
LED Lamp Stack	O	O	O	O
Overhead Electrical Services	O	O	O	O
Product Guides	O	O	O	O
Product Registration Photo-eye	-	O	S	O
PVS Indicator Lamp	O	O	O	O
Reject Actuation Confirmation	-	-	O	O
Reject Confirmation with Photo-eye	-	O	O	O
Lockable Reject Bin + Monitoring	-	O	O	O
Pack Check Photo-eye	-	O	O	O

S = Standard fitting, O + Optional fitting.

The options are described in the following sections:

Audible Alarm

The alarm sounds when a contaminated product is detected. The maximum volume of the alarm lies in the range of 110 to 125 decibels (dB) at 1 metre but the level can be adjusted.

‘Bin Full’ Photo-eye

Warns when the reject bin is full.

LED Lamp Stack

A plastic LED lamp stack, or alternatively a dome, which includes an adjustable audible alarm, is available. The lamp base is mounted on a pole on the side of the head and provides visual signalling as follows:

- **Red Lamp** – System Error.
- **Orange Lamp** – Detection / Rejection.
- **Green Lamp** – Normal Running / Inspection.
- **Blue Lamp** – Run Error / PVS Test.

Overhead Electrical Services

The Electrical Services Box may be mounted overhead instead of at the front of the conveyor as is standard.

Product Guides

Product guides are useful for centring products through the detector aperture and controlling product presentation to prevent skewing.

Three types are available. One type is situated at the infeed to the conveyor only, the second is fitted through the search head, and the third is fitted along the full length of the conveyor. The guides can easily be adjusted to suit the width of a specific product.

Product Registration Photo-eye

Conveyors that are supplied with a pusher reject are fitted with a product registration photo-eye which allows the system to count the total number of packs that have been presented for inspection. It also provides the system with a timing reference for activating reject devices and works in conjunction with other optionally fitted photo-eyes to confirm that good packs have been passed and bad packs rejected..

As standard, the photo-eye is mounted on the side of the conveyor. It is used to register the position of the products on the conveyor. As an option, the photo-eye may be mounted directly above the belt. This is particularly suitable for the registration of products that have very little depth.

PVS Indicator Lamp

Illuminates when a pre-programmed Performance Validation System test is required. The normal colour is blue but it can be white if the system uses two search heads.

Reject Actuation Confirmation

Stops the conveyor when a contaminated product is detected and the reject solenoid fails to trigger.

Reject Confirmation with Photo-eye

A photo-eye is fitted across the entrance to the reject collection device to confirm that a pack has been rejected.

Lockable Reject Bin and Status Monitor

The reject bin door is locked and unlocked through the user interface rather than with a standard key. Permission to open and lock the door is provided in the software to users with a Level 2 Supervisor access account. The status of the door lock is monitored by the software.

Pack Check Photo-eye

A photo-eye fitted onto the outfeed section of the conveyor after the reject mechanism works in conjunction with the Product Registration photo-eye to confirm that a good pack exits the system but a bad pack does not.

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Getting Started

This chapter provides some basic guidelines for initially using the IQ[3] Metal Detector.

The following sections provide more information:

- **User Interface**

  This section provides a brief description of the machine's user interface so that you may navigate around the system to make the right selections.

- **User Access**

  There are 4 levels of access that can be applied to a user account which are described in this section.

- **Logging In and Out**

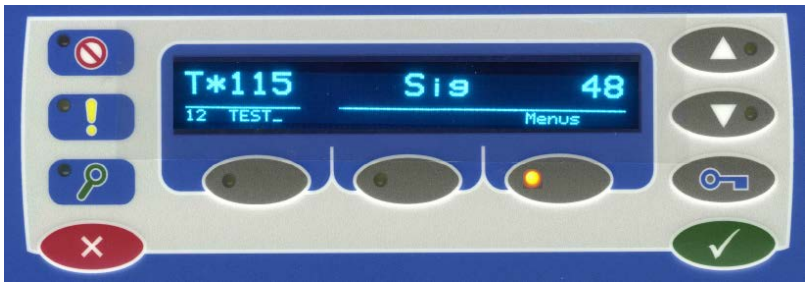
  Once a user account has been provided for you this section describes how to log in and out of your account.

- **Starting and Stopping**

  Guidance is provided for each inspection machine type, describing how to start and stop the machine; including stopping the machine in an emergency.

User Interface

The IQ[3] Metal Detector provides a two line display user interface shown below, in conjunction with a number of buttons that enable you to navigate to system options and make changes as required.



Operator Keys

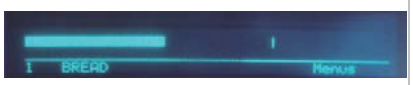
	Cancel Key When this key is selected the display navigates back to the previous display menu option.
	Menu Soft Key When the LED is lit, pressing the key will display other menu options in the two line display..
	Menu Navigation Up Key When the LED is lit this indicates that there are other menus or menu options available which you can navigate up to display.
	Menu Navigation Down Key When the LED is lit this indicates that there are other menus and menu options available which you can navigate down to display.

	Access Levels Key Navigates you to the Access Levels options so that you may change the level of access you currently are using. You will need to enter the correct password set for the level you wish to access.
	OK / Enter Key Used when you want to select a menu option to change its value and then to confirm and implement the change.

Indicators

	System Fault LED When the LED is lit, this indicates a system fault
	Run Error LED When the LED is lit, this indicates a run error.
	Inspecting LED When the LED is lit, this indicates that the system is inspecting.

Displays

	Threshold / Signal Display The top part of the display shows the signal, together with the threshold above which packs will be rejected. The signal is updated continuously as the signal changes. The bottom part of the screen displays the number and name of the currently selected product. It also shows the top level Menus option.
	**Bargraph Display** The bargraph display shows the signal in bargraph form, with the threshold point represented by a fixed vertical bar approximately three-quarters of the way along the display.

Using the Menus

The options for setting up, learning a product and checking the operation of the metal detector are accessed through the Menu Soft Keys. See the Menu Map for further information.

The menus available to you depend on the access level that you are currently logged in at.

When the LED is lit on a **Soft Menu Key** or **Menu Navigation Key**, this indicates that the key is active and can be selected to display a new menu, menu option or to change a menu option value.

Selecting a Menu

- Press the active **Soft Menu Key** directly under the displayed option you wish to select.

Editing a Menu Option

An asterisk (*****) indicates a menu option that can be edited.	
After pressing the **OK / Enter Key** to select the menu option for editing, an arrow points to the value being edited.	

- Press an active **Menu Navigation Key** to edit the value.

  If the value is a number it will increase or decrease.

  If the value has alternatives such as **YES** or **NO** pressing a key will cycle the value between the alternatives.

- Once the correct value is being displayed, press the **OK / Enter Key** to confirm the change.

Editing a Text Field

- Press the **OK / Enter Key** to edit the first character. A blank space is displayed if there is no existing character.
- Use the **Menu Navigation Keys** to step through the available characters until the correct one is displayed. Characters available are - Dots, Dashes, Underlines, Spaces, Numbers 0 to 9, and Letters A to Z.
- Press the **OK / Enter Key** to confirm selection of the first character and to select the second character for editing.
- Use the **Menu Navigation Keys** to select the second character and press the **OK / Enter Key** to confirm its selection and to select the third character for editing.
- Repeat the above process until all characters have been selected.

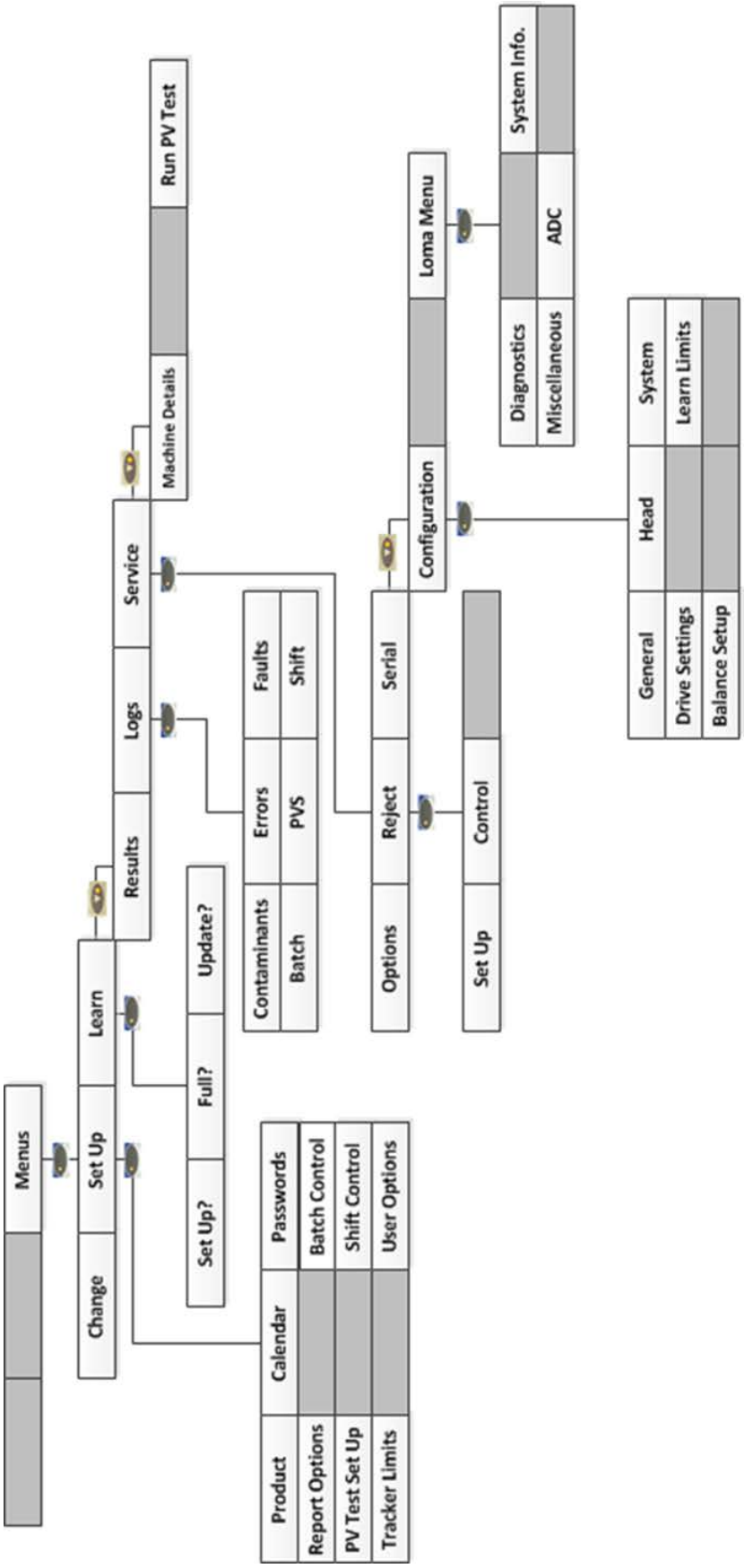
  Note that you will then need to press the **OK / Enter Key** for all available characters, so if you haven't used them all you must keep pressing the **OK / Enter Key** until the asterisk (*) appears at the beginning of the option display to indicate that all characters have been selected.

Electrical Services Box

When the IQ^3 Metal Detector head is supplied fitted to a Loma conveyor, the following switches and buttons are also provided, mounted on the Electrical Services Box:

	The **Isolator Switch** is located on the front of the Electrical Services Box and is shown here in the **ON** position. Power is being supplied to the machine.
	The **Isolator Switch** is shown here in the OFF position. Power is NOT being supplied to the machine.
	The conveyor **Start/Stop** button is located on the front of the Electrical Services Box and is used to start and stop the conveyor. Pushing the green section at the top of the button starts the conveyor and the white LED located in the middle of the button is lit to indicate this. Pushing the red section at the bottom of the button stops the conveyor and the white LED is extinguished.
	The **Emergency Stop** button is located on the front of the Electrical Services Box and is to be used in EMERGENCIES ONLY to stop the machine.

IQ3 Dual Line Display Menu Map



User Access

User access to the features and functionality of the IQ^3 Metal Detector is managed through four password protected levels, listed and described below, with each level providing access based on the user function.

Some customers do not want to have levels of restricted access for their machines. So through the Service menu the access levels may be disabled, providing full access to all users without having to log in at a specific user level.

Also, through the Keylock button, a 'Locked' option is provided for use once you have finished using the machine. The next user will then have to unlock the option and enter the password for the applicable level to start using the machine.

In addition, an Access Timeout feature is provided which will automatically lock the machine when it senses no activity for a period of 5 minutes.

During installation and commissioning, the Loma Engineer will set and provide you with passwords for accessing all user levels which you can then provide to staff as required.

You will only be able to access a function that is available to your current logged in user level.

- **Operator**

  This level of access is aimed at operators who need to use the machine functionality and features to carry out routine product inspections and remove any contaminated products from the production line.

- **Supervisor**

  This level of access is aimed at supervisors who need to use the machine functionality and features to manage the selection and inspection of a range of products. It also includes access to features and functionality available to the Operator user.

- **Quality**

  This level of access is aimed at benefits quality staff who need to monitor and analyse inspection data to ensure that acceptable quality standards are achieved and maintained for all products inspected to meet customer and legislative requirements. It also includes access to features and functionality available to the Operator and Supervisor users.

- **Engineer**

  This level of access is aimed at engineers and technicians who need to carry out routine servicing and maintenance tasks to assure the high availability and performance of the machine. It is also used during initial installation and commissioning of the machine by the Loma Engineer. This user level includes access to features and functionality available to the Operator, Supervisor and Quality users.

Inspection will be stopped when you access some functions that affect the operation of the machine.

It is recommended that you select the 'Locked' option through the Keylock button once you have completed your activities to prevent unauthorised access to features and functionality.

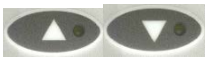
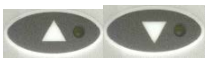
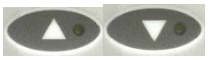
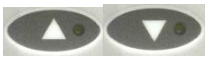
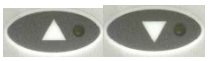
Logging In and Out

This section provides guidance for logging in and out of the IQ[3] Metal Detector.

Logging In

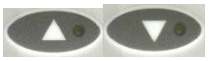
The following procedures assume that the machine is switched on and working normally and that machine access has been 'Locked'.

To log in to the machine proceed as follows:

1.	Select the ***Keylock*** button to display the current user level, which should be LOCKED if this was set by the last user.
2.	Use the ***Scroll*** buttons  to select the required user level.
3.	Press the ***Tick*** button twice to select the first password number for editing.
4.	Use the ***Scroll*** buttons  to select the required password number.
5.	Press the ***Tick*** button twice to confirm the selection and display the second password number for editing.
6.	Use the ***Scroll*** buttons  to select the required password number.
7.	Press the ***Tick*** button twice to confirm the selection and display the third password number for editing.
8.	Use the ***Scroll*** buttons  to select the required password number.
9.	Press the ***Tick*** button twice to confirm the selection and display the fourth password number for editing.
10.	Use the ***Scroll*** buttons  to select the required password number.
11.	Press the ***Tick*** button to confirm the selection.
12.	You are now logged in at the selected user level.

Logging Out

To log out of machine, proceed as follows:

1.	Select the ***Keylock*** button to display the current user level, which following on from the process above should be ENGINEER.
2.	Use the ***Scroll*** buttons  to select the LOCKED user level.
3.	Press the ***Tick*** button to confirm the selection.
4.	You have now logged out and 'Locked' the machine.

Starting and Stopping

This section provides guidance for starting and stopping the IQ^3 Metal Detector, including stopping the machine in an emergency.

The following procedures should only be carried out once all installation and commissioning activities have been completed and operators trained in the use of the machine.

Starting the Machine

To start the machine proceed as follows:

1.	Ensure that the machine is connected to a suitable power supply and, if a pneumatic reject device is fitted, a suitable air supply.
2.	Turn the **Isolator Switch**, located on the Electrical Services Box, in a clockwise direction. This will switch on the electrical supply to the machine.
3.	The machine will then load its operating software and display the software version details in the 2 line display.
4.	Once the software has been loaded the current Threshold / Signal is displayed. The top part of the display shows the signal, together with the threshold above which packs will be rejected. The signal is updated continuously as the signal changes. Pressing the Key button, in Supervisor level or above, allows adjustment of the threshold level. The bottom part of the screen displays the number and name of the currently selected product. It also shows the top level menu key
5.	Push the green **Start** button to start the conveyor.
6.	The machine is now ready to start inspecting the selected product.

Stopping the Machine

To stop the machine, proceed as follows:

1.	Push the red **Stop** button to stop the conveyor.
2.	If you have finished using the machine, turn the **Isolator Switch** in an anti-clockwise direction. This will switch off the electrical supply to the machine.

Emergency Stop

To stop the machine in an emergency, proceed as follows:

1.	Press the red **Emergency Stop** button located in the centre under the user display. The conveyor will then automatically stop.

Starting the Machine after an Emergency Stop

To start the machine after an emergency stop, proceed as follows:

1.	Ensure that any issue that caused you to stop the machine has been cleared.
2.	Turn the red **Emergency Stop** button clockwise to release the button which will then pop out to its original position. The power supply to the conveyor is now restored.
3.	Push the green **Start** button to restart the conveyor.
4.	The machine is now ready to start inspecting the selected product.

Using the Metal Detector

This chapter provides general information about using the IQ^3+ Metal Detector, including some guidance on setting up the detector to provide the best results.

The following sections provide more information:

- **Good Practice**

  This section provides some guidance for maintaining an effective metal detection regime.

- **Establishing a Good Product Learn**

  Carrying out a full product learn is an essential first step to ensure that the metal detector performs effectively.

- **Establishing Detector Performance**

  Once a product learn has been completed, the next step is to establish the levels of metal detection achievable.

- **Regular In-Line Detector Performance Testing**

  Regular testing of the detector's performance, including checking activation of reject devices, provides confirmation and continued confidence in its detection capabilities.

- **Handling Rejected Products**

  Effective removal of contaminated products from the production line to ensure that they are not delivered to customers is an essential part of the inspection process.

- **Getting the Results**

  The IQ^3 Metal Detector has built in inspection settings to achieve the best detection results for a wide range of product types, including those that create no product effect.

- **Frequency Selection**

  Although the detector operates across a range of frequencies, generally a product will have an optimum frequency at which detection is best. This frequency can be manually set but the IQ^3 Metal Detector has the capability built in to automatically search for and select it.

Good Practice

The following guidelines include recommendations for ensuring and maintaining an effective metal detection regime. There are four essential components in using the IQ^3 Metal Detector effectively:

- Establishing a Good Product Learn.
- Establishing Detector Sensitivities.
- Regular In-Line Detector Sensitivity Testing.
- Handling Rejected Products.

These four components are described in detail in this chapter.

Establishing a Good Product Learn

Before inspecting products for inclusion of metal contaminants, you must first carry out a full product learn process. See Learning Products for further details.

This process consists of passing known good product packs through the detector so that it can establish what effect the product has on the electromagnetic field as it passes through the aperture.

Based on this product effect, the metal detector automatically makes the required settings in the software and establishes a product window or envelope which is saved in memory for use every time the product is selected for inspection.

The product effect is then effectively filtered out from the signal received when being inspected so that signal variations caused by metal contaminants can be easily detected.

Carrying out a full product learn process is therefore a very important first step to ensure that the metal detector performs effectively.

Establishing Detector Performance

Introduction

Once the metal detector has been set up with the product it is important to establish what size of metal contaminant the detector is capable of finding and if necessary make manual adjustments in the metal detector settings to achieve the required results.

This is achieved by attaching various sizes and types of metal to know good product samples and passing them through the metal detector aperture to establish the level of detection that is achievable.

Loma Systems can supply a selection of sizes and types of metal test wands for attaching to product samples for testing purposes. There are three types of wands: ferrous (chrome steel), non-ferrous (brass), and 304 stainless steel. Stainless steel is included because sensitivity is generally poorer than to other non-ferrous contamination due to the relative conductivity of the material. The wands are supplied in a range of sizes depending on the product type being inspected.

In dry running the sensitivity can be measured by placing the test wand at the trailing and leading edges of a representative sample of the product, and then passing the product through the detector. The test wands should be placed at the leading and trailing edges of the product to ensure correct product rejection. This is particularly important in metal detectors with no Product Registration Photo-eye fitted, as the reject time is determined by the position of the contaminant relative to the product.

With conductive products the signal generated by the metal contaminant can be masked by the product itself. It is therefore important to test the product with test wands not only at the leading and trailing edges, but also at the product‘s centre.

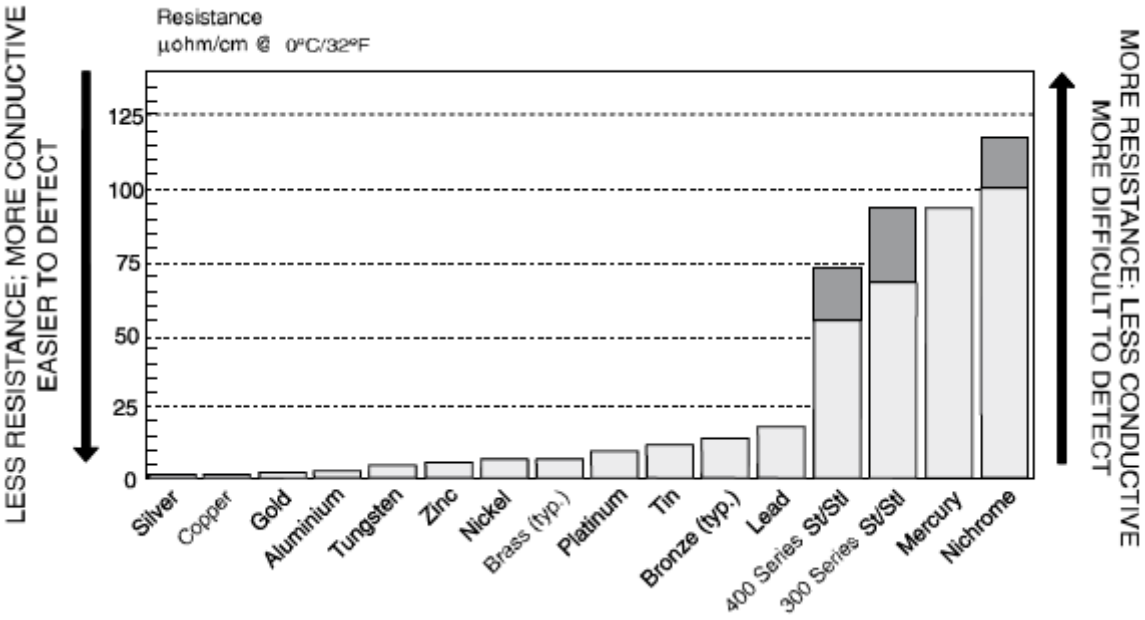
Relative Detectability of Non-Ferrous Metals

The resistance, and hence ease of detection, of different non-ferrous metals varies widely. The more conductive they are, the easier they are to detect, as shown in the graph below.

Sensitivity to stainless steels is invariably poorer than to other non-ferrous contamination. This is largely due to the relative conductivity of the material.

It is also possible to phase out a particular size of non-ferrous contaminant but be able to detect a smaller or larger size. This is because the metal signal matches the product signal and has been compensated out.

It is important to be aware of the effects of contaminant orientation and relative detectability. The test wands used throughout the metal detection industry are spherical, as this eliminates any orientation effects and ensures repeatability. However, in practice this may not always be the case, therefore the user must be mindful of this fact.



Regular In-Line Detector Performance Testing

It is important to maintain regular and accurate in-line performance testing of the metal detector using the same techniques as the initial performance testing. This should include tests to ensure that the reject systems are effective. See Using Performance Validation for further details.

Regular testing should be conducted using the same techniques as initial performance testing. This should include ensuring that the reject systems are effective, including reject confirmation systems if fitted.

The records generated by this system should be maintained in a safe and easily retrievable place for a time period suited to your particular quality regime. Factors which may be of help in determining a suitable retention period might be:

- The anticipated life of your product within normal consumer usage.
- Any statutory time period within which enforcement authorities may instigate legal proceedings after notification of a complaint.

Handling Rejected Products

A reject collection device, such as a reject bin, will typically be used to prevent contaminating products from being mixed with uncontaminated products. Any rejected product should be kept segregated for later examination. Never let your bin overfill.

It is advisable to examine rejected product with a view to identifying any contamination.

The information gained can be used to implement preventative measures, thus improving further the product. Multiple contaminants may be a clue to machinery break-up. Identification can then pinpoint the source and effective maintenance can then be conducted.

The IQ^3 Metal Detector can also be helpful when examining contaminated products. For example, you can alter the orientation of the product and pass it back through the metal detector to help identify its position. Alternatively, you can subdivide a large product into a number of smaller samples and then use the metal detector to identify which sample contains the contaminant.

Getting the Results

Before using the metal detector with a new product it is important to learn the product, to allow the metal detector to adjust itself to the highest possible sensitivity.

The metal detector will either learn on the signal from the product, or if there is insufficient signal, will use reference learn settings. This reference signal is chosen to maximise the sensitivity of the metal detector, so it is always preferable. However, where a product generates a signal in the detector, referred to as product effect, then the detector must learn this signal instead (otherwise good product will falsely be rejected).

When there is no signal from the product this is because they are non-conductive in nature, usually because they are dry (low water content) such as tea and coffee. Frozen products are also dry in nature because water cannot conduct when it is frozen. During a product learn, the detector will automatically sense if it is possible to run dry (use the reference learn setting), but this can also be forced by selecting DRY YES in the product menu.

Frequency Selection

The IQ^3+ Metal Detector can run at a choice of seventy different operating frequencies so that the optimum frequency can be chosen for any given product. Generally, dry products run at high frequencies, but more conductive and non-uniform products run at low frequencies.

The frequencies are split into 10 bands as shown in the table below. This resolves any issues with cross-talk between two metal detectors working in close proximity. By setting one detector to use the available frequencies in a different band to the other detector they will never be operating on the same frequency.

Band	**Frequencies (KHz)**						
Band 1	31	71	111	203	300	405	576
Band 2	33	73	115	208	319	416	600
Band 3	35	75	121	211	326	428	625
Band 4	37	77	126	217	333	441	652
Band 5	39	79	131	223	340	454	681
Band 6	41	81	136	231	348	468	714
Band 7	43	83	141	238	357	500	750
Band 8	46	85	146	242	365	517	789
Band 9	48	87	151	250	375	535	833
Band 10	52	89	156	254	384	555	882

Because only the most experienced user will be able to correctly choose the optimum frequency, the product Learn process on the metal detector will automatically select the most suitable frequency. To allow the metal detector to select the best frequency, simply go to ***Menu>Learn>Set Up*** and select the **Auto-Frequency** option.

Where several detectors are sited close together, it is essential that they do not run at the same frequency. This is achieved by allocating them separate frequency bands, which will have been set as part of the commissioning process.

Operating Instructions

This chapter provides general information about using the metal detector, including some guidance on setting up the detector to provide the best results.

The following sections provide more information:

- **Setting Up the Metal Detector**

  This section provides guidance for setting up some basic features of the metal detector.

- **Configuring the Metal Detector**

  This section provides for configuring the available options to provide an effective metal detection system.

- **Adding a New Product**

  This section provides guidance for adding a new product into the system for inspection.

- **Learning Products**

  This section provides guidance for setting up the Lean feature and then 'Learning' a product.

- **Using Performance Validation**

  This section provides guidance for setting up the PVS feature and then carrying out a PV test for a product.

Setting Up the Metal Detector

Setting Up the Metal Detector

This section provides guidance covering how to set up some basic features of the metal detector.

- **Setting the Time and Date**

  This section describes how to set the time and date to be used by the detector. It is important that this is synchronised with other production equipment to assist with any investigations.

- **Setting the Language**

  This section describes how to set the language to be used by the detector. A wide range of languages are available for selection and the process is very simple.

- **Setting the Machine ID**

  This section describes how to set a unique name / number identifier for the metal detector. This is useful for data analysis purposes when you are using more than one detector as the machine ID is provided at the top of all Logs and Reports.

- **Setting User Access Level and Password**

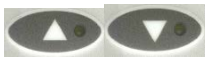
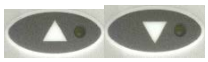
  Use accounts are created at one of four access levels from 1 to 4. Level 1 provides basic operator access whilst level 4 provides access to all of the detector's features and functionality.

Setting the Time and Date

It is important that the correct time and date are set on the machine as they are used to time stamp the data in the contaminant, fault and error logs and are shown on the reports. In addition they determine the interval and synchronisation of automatically initiated PV tests.

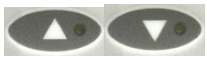
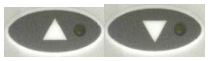
*The following procedures assume that the machine is switched on and working normally and that you are logged into the machine with sufficient access rights to access the **Menus > Set Up > Calendar** menu.*

To change the time and date, proceed as follows:

1.	Select ***Menus > Setup > Calendar*** to display the **Calendar** menu options.
2.	Use the **Navigation Keys**  to select the **Year** option and press the **OK / Enter Key** to enable the current value to be edited.
3.	Use the **Navigation Keys**  to select the required **Year** and then press the **OK / Enter Key** to confirm the selection.
4.	Repeat steps 2 and 3 above to select the required values for the **Month**, **Day**, **Date**, **Hours** and **Minutes** options.

Setting the Language

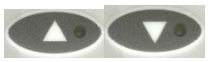
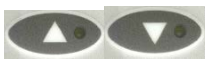
To set the system language, proceed as follows:

1.	Select ***Menus > Service > Configuration > General*** to display the **General** menu options.
2.	Use the **Navigation Keys**  to select the **Language** option and press the **OK / Enter Key** to enable the current value to be edited.
3.	Use the **Navigation Keys**  to select the required **Language** and then press the **OK / Enter Key** to confirm the selection.

Setting the Machine ID

The Machine ID is printed out on any Reports or Logs and can be edited to a convenient name to allow them to be easily associated to a machine. Up to six characters, either letters or numbers, may be entered.

To set the Machine ID, proceed as follows:

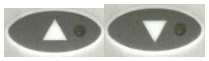
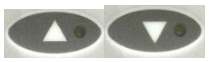
1.	Select ***Menus > Machine details*** to display the **Machine details** menu options.
2.	Use the **Navigation Keys**  to select the **Machine** option and press the **OK / Enter Key** to enable the first character of the required Machine ID to be entered.
3.	Use the **Navigation Keys**  to select the required first character (letter or number) to be used for the Machine ID and then press the **OK / Enter Key** to confirm the selection. This will then automatically select the second character for editing.
4.	Repeat step 3 until you have selected and confirmed each character required for the Machine ID. Up to six characters may be used.
5.	Once you have entered the required Machine ID, press the **Cancel Key** to exit the Machine menu.

Setting User Access Levels and Passwords

User accounts are used to manage access to the features and functionality available in the metal detector. Four access levels are available, which are described in the User Access section, and you may set specific passwords for each level. The password can consist of up to 4 numbers, from 0 to 9..

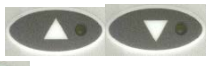
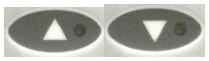
You may also optionally select not to use the access levels feature so that anyone using the machine has unrestricted access to all of the available features and functionality.

To set the User Access Level passwords, proceed as follows:

1.	Select ***Menus > Service > Passwords*** to display the **Passwords** menu options.
2.	Use the **Navigation Keys**  to select the **Operator** option and press the **OK / Enter Key** to enable the first number for the Operator user access level password to be entered.
3.	Use the **Navigation Keys**  to select the required first number and then press the **OK / Enter Key** to confirm the selection. This will then automatically select the second number for editing.
4.	Repeat step 3 until you have selected and confirmed each number required for the Operator user access level password. Up to four numbers may be used.
5.	Once you have entered the required password, press the **Cancel Key** to display the **Passwords** menu options again.
6.	Then repeat steps 2 to 5 to enter passwords for the **Supervisor**, **Quality** and **Engineer** access levels.

Turning Off the Access Level Feature

To turn off the User Access Levels feature, proceed as follows:

1.	Select ***Menus > Service > Configuration > General*** to display the **General** menu options.
2.	Use the **Navigation Keys**  to select the **Access Levels** option and press the **OK / Enter Key** to enable the current value to be edited.
3.	Use the **Navigation Keys**  to select either the **ON** or **OFF** option and then press the **OK / Enter Key** to confirm the selection.

Configuring the Metal Detector

Wherever possible, configuration of the metal detector will be carried out by Loma Systems before the machine is dispatched, or by a Loma Service Engineer during a commissioning visit. Primarily, the commissioning visit is required as part of the installation process so that the engineer can optimise machine performance in its actual working environment and for the products that are to be inspected.

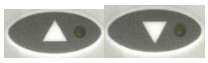
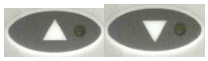
There are circumstances, however, where it may be necessary for the end user to carry out some or all of the configuration and commissioning procedures. Typically, this would occur when Loma Systems do not have enough information about the end application, such as the belt speed or reject details, to fully configure the machine.

Options and parameters available for configuring the metal detector are listed and described below.

- Setting Up the Search Head
- Setting Up the Conveyor
- Setting Up the Service Options
- Setting the VF Balance
- Setting the VF Drive
- Setting Up the User Options
- Setting Up Serial Links
- Performing a Ferrite Tune
- Setting Up Product Signal Tracking
- Setting Up the Reject Options

Setting Up the Search Head

To set up the search head, proceed as follows:

1.	Select ***Menus > Service > Configuration > Head*** to display the **Head** menu options which are listed and described below.
2.	Use the **Navigation Keys**  to select each option in turn press the **OK / Enter Key** to enable the value to be edited.
3.	Use the **Navigation Keys**  to select the required option value and then press the **OK / Enter Key** to confirm the selection.
4.	Repeat step 2 and 3 until you have selected and confirmed values for each option.

The Head menu options available are as follows:

- **Type**

  The 'Conveyor' option should be selected for the IQ^3 metal detector search head.

- **Coil gap**

  The coil gap required can be found on the serial number plate located within the control box of the detector head. It is set at 0.6 times the smallest aperture dimension, which is generally the aperture height.

■ **Band**

Frequency bands are used to prevent crosstalk between adjacent metal detectors that are operating on the same frequency.

The options are OFF, or 1 through 10. If OFF is selected then all seventy (70) frequencies, 31 through 882, will be available for use for all products, making frequency selection and subsequent Learns a manual process.

If a band number is selected then the 7 frequencies available in that band are used by the metal detector when selecting the optimum inspection frequency for any product.

The available frequencies are banded as listed below, with all values shown in kHz:

- **Band 1:** 31, 71, 111, 203, 300, 405 and 576
- **Band 2:** 33, 73, 115, 208, 319, 416 and 600
- **Band 3:** 35, 75, 121, 211, 326, 428 and 625
- **Band 4:** 37, 77, 126, 217, 333, 441 and 652
- **Band 5:** 39, 79, 131, 223, 340, 454 and 681
- **Band 6:** 41, 81, 136, 231, 348, 468 and 714
- **Band 7:** 43, 83, 141, 238, 357, 500 and 750
- **Band 8:** 46, 85, 146, 242, 365, 517 and 789
- **Band 9:** 48, 87, 151, 250, 375, 535 and 833
- **Band 10:** 52, 89, 156, 254, 384, 555 and 882

■ **Default**

With banding set to OFF the initial operating frequency for all products defaults to the lowest available of 31KHz. This of course can be changed to whichever frequency it is desired to start from.

When banding is set then it is recommended to set the default frequency as suggested by the following:

0 Aperture dimension in the range of 75 - 125mm - depending upon the band selected, use the 405kHz upwards range.

o Aperture dimension in the range of 150 - 200mm - depending upon the band selected, use the 300kHz upwards range.

0 Aperture dimension in the range of 225 - 300mm - depending upon the band selected, use the 203kHz upwards range.

0 Aperture dimension in the range of 325 - 550mm - depending upon the band selected, use the 111kHz upwards range.

Any change made to the value after the Head menu is exited will change all product memories back to the new value selected. Therefore it is advised not to revisit this entry unless necessary.

■ **Ferrite frequency**

The IQ^3 Metal Detector uses a product called “Ferrite” to provide a pre-set compensation value that the detector can recall to use with any product that when learnt exhibits no signals when passed through the detector aperture. The ferrite frequency is normally set to the same value as the default frequency.

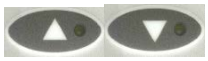
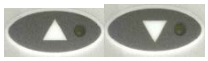
Irrespective of whether banding is used or not the „Ferrite“ product has to be set up using the “Tune for resistive” clear plastic wand found within the control box area.

Learning the wand is the same as learning a product and can only be done when the **Photeye** option in the **Menus** > **Service** > **Configuration** > **System** menu has been set to **NO**. Once Ferrrite has been learnt then further access should be denied to prevent accidental use. To do this, navigate to the **Menus** > **Service** > **Options** menu and set the **Access Ferrite** option to **NO**.

Factory frequency setting for ferrite is selected from the smallest aperture dimension and will be the same as the default frequency. Therefore, depending upon the band selected, it will be from the same range listed above. Should there be a change to the set band then the ferrite memory would have to be re-learnt using a frequency from the new band used.

Setting Up the Conveyor

To set up the conveyor, proceed as follows:

1.	Select ***Menus > Service > Configuration > System*** to display the **System** menu options which are listed and described below.
2.	Use the **Navigation Keys**  to select each option in turn press the **OK / Enter Key** to enable the value to be edited.
3.	Use the **Navigation Keys**  to select the required option value and then press the **OK / Enter Key** to confirm the selection.
4.	Repeat step 2 and 3 until you have selected and confirmed values for each option.

The System menu options available are as follows:

- **Photoeye**

  This option refers to the optional Product Registration Photo-eye that is located on the infeed of the conveyor. When the option is enabled the photo-eye acts as a timing start point for both correct detection and subsequent reject timing functions.

  Select the **YES** option if a photo-eye is fitted and the **NO** option if it is not.

- **PEC fault**

  This option is displayed if the Photoeye option has been set to **YES**. When the option is enabled, should the photo-eye become blocked for any reason a system fault will be generated. Depending on the reject and conveyor setup the conveyor will then stop and/or a reject actuation will occur. Three options are available for selection as follows:

  - **Off**

    Selecting this option disables the PEC fault functionality.

  - **Latched**

    Select this option if the fault must be manually cleared after the PEC has been unblocked.

  - **Auto Clear (default)**

    Select this option if the fault is automatically cleared after the PEC has been unblocked.

- **PEC length**

  To ensure the correct operation of the detector and reject systems it is extremely important to ensure that this setting is correct.

The calculation for this entry, measured in mm or inches, depends on the **Units** option selected in the ***Menus > Service > Configuration > General*** menu. It is calculated as follows:

1. Measure the distance from the Product Registration Photo-eye to the face of the detector (L).
2. Measure the depth of the detector case (D).
3. Note the (Rx) distance recorded on the detector serial plate located behind the detector control panel cover.
4. Put the values into the formula - PEC length = A + (0.5 x D) + Rx.
5. Enter the value as required.

- **PEC block packs**

  If the Product Registration Photo-eye is blocked for the selected number of packs, the detector will identify this as a fault. Any number of packs may be entered but the default value is 6.

- **Speed mode**

  There are three options available for selection as follows:

  0 Fixed

  Select this option if you are using a fixed speed conveyor system. When selected, both reject delay and dwell timing must be set in the Rejects Setup screen.

  0 Variable

  Select this option if you are using a conveyor system where the speed is variable or can be stopped from an external control source. When in use the conveyor drive will have a shaft encoder fitted that provides timing pulses to the detector electronics whilst the conveyor is running. A CTB constant entry field and an option to log speed problems will be visible. When selected both reject delay in distance and dwell timing in time or distance must be set in the Rejects Setup screen.

  0 Freerun

  Select this option when there is no transport system in use, other than the effects of gravity. When selected, the reject dwell timing must be set in the Rejects Setup screen. A DSP enable option will be visible.

  Tap the arrow to the right of the field to display the drop down list of available speed mode options and select the one to be used.

- **Belt speed**

  This field is displayed if the Fixed speed mode option has been selected. It is important for the correct operation of the overall system that this entry reflects the actual conveyor speed. The value can be in metres per minute or feet per minute depending upon the **Units** option selected in the ***Menus > Service > Configuration > General*** menu.

- **CTB constant**

  This field is displayed when the Variable Speed mode option is selected.

  The value entered is derived from the relationship between the shaft encoder and circumference of the roller to which it is fitted.

  This parameter is the number of pulses (ticks) per metre/foot of belt travel. To calculate this figure for entry into the CTB constant field, use either the following metric or imperial formula:

- **Metric systems**

  CTB = Encoder pulses per revolution x 100 x **TT** x d

  Where: d = the diameter of the roller to which the encoder is fitted in millimetres.

- **Imperial systems**

  CTB = Encoder pulses per revolution x **TT** x d

  Where: d = the diameter of the roller to which the encoder is fitted in inches. The number of pulses provided directly relates to the transport speed. JP7 on the detector control board must be set in position 1-2.

- **Log speed prob**

Because the detector can only work within a predetermined speed range it is possible for the belt speed to move outside the limit of reliable operation of the machine. Selecting the Log speed prob option will generate either speed too slow or speed too fast run errors to advise operators.

- **DSP type**

DSP stands for Digital Signal Processing. The following options are available for selection:

- **Off**

  The resultant signal is based directly on how much the product signal deviates from the Learnt product reference. Use this option where there is a high level of environmental noise.

- **Standard**

  The resultant signal is produced using a tuned detection filter. This is the standard method of detection for conveyor and pipeline heads. For reactive product the Rate option can give enhanced performance.

- **Wide**

  This detection filter is used where the product speed is not known. For example in free fall and pharmaceutical applications.

- **Rate**

  This filter is based on how quickly the field changes. This is the recommended option for reactive product.

- **Product Limit**

You can restrict the number of products that you can add to the system by entering a value, subject to a maximum of 200.

- **Alarm Output**

In some instances, such as when carrying out product testing, you may wish to turn off the audible alarm. Options are provided to Energise or De-Energise the audible alarm.

- **Lamp Type**

Options of Dome and Stack are provided. The IQ3 Metal Detector system is generally supplied with an LED Lamp Stack so the Stack option should be selected.

- **Noise Filter**

  This feature provides options for automatically filtering out background noise which could affect the identification of contaminants in products. Options of OFF, LOW and HIGH are provided for selection.

- **Control Board**

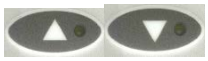
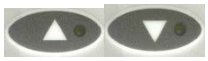
  The control board type that is currently fitted to the detector head is displayed. This is not editable.

- **RX TX Board**

  The RX TX board type that is currently fitted to the detector head is displayed. This is not editable.

Setting Up the Service Options

To set up the service options, proceed as follows:

1.	Select ***Menus > Service > Options*** to display the **Service Options** menu options which are listed and described below.
2.	Use the **Navigation Keys**  to select each option in turn press the **OK / Enter Key** to enable the value to be edited.
3.	Use the **Navigation Keys**  to select the required option value and then press the **OK / Enter Key** to confirm the selection.
4.	Repeat step 2 and 3 until you have selected and confirmed values for each option.

The Service Options menu contains the following options:

- **Tracker**

  Enabling the Tracker functionality allows product threshold values to follow any changes in measured product effect. This option is only available when a product registration photo-eye is in use. See Enabling the Tracker Feature for further details.

- **Reject time**

  Selecting this option enables the Reject delay and Reject dwell values to be updated.

  Therefore, leaving this option disabled prevents accidental changes being made to the reject timings.

- **Set Up Learn**

  Selecting this option enables the Menus > Learn > Set Up menu to be displayed for selection.

- **Access ferrite**

  Selecting this option allows access to the Ferrite (F) product option in the Menus > Change menu.

  As this product is setup in the factory and its settings used by the detector as the baseline for inspecting Dry products, access should be disabled to avoid incorrect use.

  Access is generally enabled by a Loma Service Engineer when the Ferrite product needs to be re-learnt following replacement of a circuit board or upgrading of the detector software.

- **Reject in Learn**

  If this option is selected all packs will be rejected during a product learn process, regardless of whether they include contaminants.

- **Auxiliary relay**

  The following options are available for selection, depending on what function the relay is providing:

  - **In run**

    Select this option if you are using the relay to signal that the metal detector is inspecting product.

  - **Reject**

    Selecting this option provides an additional set of reject activated contacts.

  - **Check debug**

    Select this option to assist with setting up the Pack check feature, enabled in the Rejects Setup screen.

- **PV Test**

  Selecting this option enables the Performance Validation feature for the currently selected product, using the options selected in the ***Menus > Set Up > PV Test Set Up*** menu.

- **Reverse mode**

  If this option is selected then the detector will work in reverse by passing 'contaminated' products and rejecting 'good' products.

  This is useful when for example a product contains a metal 'toy' so products that do not contain the 'toy' are to be rejected.

  Note that a Product Registration Photo-eye must be fitted to use this option.

- **Access Filter**

  If this option is selected then the Detection Filter option is included for selection in the ***Menus > Learn > Set Up*** menu.

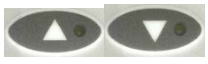
Setting the VF Balance

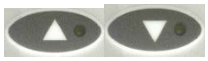
Setting the balance on the raw P and Q channels for all available operating frequencies to maximise sensitivity of the detector is carried out in the **Balance Setup** menu. This is completed during the machine manufacturing process so should not need adjustment under normal operating conditions.

However, if any of the electronics are replaced it is recommended that the setup is repeated. This is normally done using the AutoBalance feature which automatically makes any P and Q channel balance adjustments necessary for each of the available frequencies.

Manual adjustment is also possible and this is carried out by Loma Service Engineers when required.

To set up the VF Balance, proceed as follows:

1.	Select ***Menus > Service > Configuration > Balance Setup*** to display the **Balance Setup** menu options which are listed and described below.
2.	Use the **Navigation Keys**  to select each option in turn press the **OK / Enter Key** to enable the value to be edited.

3.	Use the **Navigation Keys**  to select the required option value and then press the **OK / Enter Key** to confirm the selection.
4.	Repeat step 2 and 3 until you have selected and confirmed values for each option.

The Balance Setup menu contains the following options:

- **Frequency**

  The IQ^3 has seventy (70) different operating frequencies ranging from 31kHz up to 882kHz. Each of the available frequencies can be selected by scrolling through the list.

  Note that the frequency selected in this menu is independent of the frequency for the currently running product.

  When a frequency is selected from the list, the current setting for the receiver P and Q channel potentiometer positions together with the balance can be viewed.

  When the menu is exited, the detector will restore the current running products' operating frequency.

- **Pot position**

  The potentiometer positions for the P and Q channels of the selected operating frequency are displayed. The potentiometers are used to select the signal size that is injected into each channel to balance them out.

  These values are automatically set for the selected frequency by the software when the AutoBalance feature is used.

  The potentiometer positions can be manually adjusted within this menu, but this is not recommended.

- **Balance setpoint**

  The target value for the balance between the P and Q channels is displayed. The default value is 100.

- **Balance**

  The measured balance between the P and Q channels on the receiver board is displayed as a read-only value.

  When the detector has been configured correctly, the measured balance will generally be lower than the balance setpoint.

  If in doubt contact your local Loma service centre for assistance.

- **Auto configure**

  Enabling this option starts the AutoBalance process for all operating frequencies. The process commences by resetting the potentiometer positions for the P and Q channels for each frequency to 50.

- **Balance reset**

  Selecting this option resets the potentiometer positions for the P and Q channels for each frequency to 50. This will often be done prior to manually balancing the head (usually at 31kHz). Remember to run the Auto configure process afterwards.

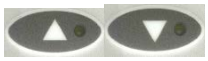
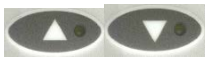
Setting the VF Drive

The transmitter drive for all available operating frequencies is set up in the **Drive Settings** menu to maximise performance of the detector. This is carried out during the manufacturing process so should not need adjustment under normal operating conditions.

However, if any of the electronics are replaced it is recommended that the setup is repeated. This is normally done using the AutoBalance feature which automatically makes any P and Q channel balance adjustments necessary for each of the available frequencies.

Manual adjustment is also possible and this is carried out by Loma Service Engineers when required.

To set up the VF Drive, proceed as follows:

1.	Select ***Menus > Service > Configuration > Drive Settings*** to display the **Drive Settings** menu options which are listed and described below.
2.	Use the **Navigation Keys**  to select each option in turn press the **OK / Enter Key** to enable the value to be edited.
3.	Use the **Navigation Keys**  to select the required option value and then press the **OK / Enter Key** to confirm the selection.
4.	Repeat step 2 and 3 until you have selected and confirmed values for each option.

The Drive Settings menu contains the following options:

- **Frequency**

  The IQ^3 has seventy (70) different operating frequencies ranging from 31kHz up to 882kHz. Each of the available frequencies can be selected from the drop down list.

  Note that the frequency selected in this menu is independent of the frequency for the currently running product.

- **Drive On**

  The drive on time for the selected operating frequency of the transmitter is shown here. It can be manually adjusted within this menu, though this is not recommended.

- **Drive Off**

  The drive off time for the selected operating frequency of the transmitter is shown here. This value is read-only and cannot be changed.

- **Drive**

  The drive current for the selected operating frequency is displayed as a read only value. This value is controlled by the drive on time setting. When the detector has been configured correctly, the value will generally be close to the Configure current value set.

  Larger aperture detectors operating at above 600kHz are likely to show a lower value. If in doubt contact your local Loma service centre for assistance.

- **Restore Drive**

  The transmitter can drop into safe mode operation 100kHz at a low drive current. For example the Drive On time of a particular operating frequency may have been manually increased causing the current limit value to be exceeded.

Even when the on time may have been manually reduced from within this screen to a safe level (usually less than 10) the transmitter will not automatically restart. Select this option to restart the transmitter.

A restored drive will display a drive current that is greater than the safe mode value. If this is the case it is recommended to start the auto configure process rather than attempt a manual on time adjustment. If the drive does not restore then the transmitter may be in shutdown.

Remove the control box front panel then drop down the internal hinged main control board to allow visual access to the left hand transmitter board. If the bottom red LED is illuminated then the transmitter is in shutdown. If only the orange led is illuminated then the transmitter is still in safe mode. In this case, try lowering the on time value a little more and perform another restore drive.

If the red LED stays on then contact your local Loma service centre for assistance.

- **Auto Configure**

  Select this option to start the full setup process for all operating frequencies. The process commences by resetting the on time values for each frequency to zero.

  The configuration progress is displayed and will close automatically upon completion.

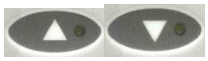
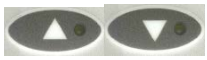
- **Configure current**

  This entry sets the target transmitter drive current that the auto configure process will use, subject to a maximum figure of 350mA.

  For conveyor detectors using the standard board, the default value is 230mA. For conveyor detectors using the auto-balance board, the default value is 350mA.

Setting Up the User Options

To set up the User Options, proceed as follows:

1.	Select ***Menus > Set Up > User Options*** to display the available menu options which are listed and described below.
2.	Use the **Navigation Keys**  to select each option in turn press the **OK / Enter Key** to enable the value to be edited.
3.	Use the **Navigation Keys**  to select the required option value and then press the **OK / Enter Key** to confirm the selection.
4.	Repeat step 2 and 3 until you have selected and confirmed values for each option.

The User options available for selection are as follows:

- **Menu Scroll**

  If this option is enabled then selecting either the Up or Down Navigation Keys will display the available options in a continuous loop. In effect you only need to keep pressing the one Navigation Key button to view all available options.

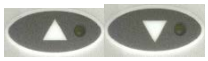
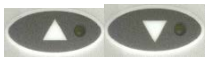
- **Bar Graph**

  Options are provided to change the display so that the product signal is shown as a bar graph rather than a number or a combination of the two displayed at the same time.

Setting Up Serial Links

Serial links are set up through the **Serial** menu which provides options for selecting the type of data to be transmitted and/or received and how the data is communicated. To enable communications over a serial link to function, the detector must have as a minimum the additional serial link board with cabling. Report options will require the further addition of an Ethernet module.

To set up a serial link, proceed as follows:

1.	Select ***Menus*** **>** ***Service*** **>** ***Serial*** to display the **Serial** menu options which are listed and described below.
2.	Use the **Navigation Keys**  to select each option in turn press the **OK / Enter Key** to enable the value to be edited.
3.	Use the **Navigation Keys**  to select the required option value and then press the **OK / Enter Key** to confirm the selection.
4.	Repeat step 2 and 3 until you have selected and confirmed values for each option.

The Serial menu options available are as follows:

- **Usage**

  Options are provided for selecting how the connection is going to be used. Four options are available which are described below.

  - **Not used**

    Select this option if you do not wish to use a serial connection.

  - **Lomalink**

    Select this option if you wish to create a connection with the LomaLink application for two-way communication and control.

    LomaLink enables data to be requested from and sent to the metal detector, and enables remote control of the metal detector.

  - **Reports**

    Select this option if you wish to send Reports and Logs over the serial connection either manually or automatically. See Logs and Reports for further details.

  - **Resultant**

    Select this option if you wish to send product resultant signals over the serial connection. If a Product Registration Photo-eye is fitted then a signal is sent for each pack as it is inspected. If a Product Registration Photo-eye is not fitted then the current signal is sent over the connection about once a second.

    The remaining menus determine the required serial connection protocol. Whichever settings are chosen they must match those used by the equipment the detector is communicating with.

- **Baud rate**

  Options for selecting the baud rate to be used for the connection are provided.

- **Data Bits**

  Options for selecting the number of data bits to be used for the connection are provided.

- **Stop Bits**

  Options for selecting the number of stop bits to be used for the connection are provided.

- **Parity**

  Options for selecting the parity to be used for the connection are provided.

- **Flow control**

  Options for selecting the flow control to be used for the connection are provided.

Performing a Ferrite Tune

A “Ferrite“ product is set up during manufacture of the detector head to provide a baseline configuration for inspecting “Dry“ products which exhibit no product effect during inspection.

A part of this process a “Ferrite Wand“, similar to a Test Wand but much larger and containing a sample of pure iron, is used to carry out a Full Learn process. This is called a Ferrite Tune. The “Ferrite Wand“ used then becomes specific to the detector head and is provided with the head to enable future Ferrite Tunes to be carried out.

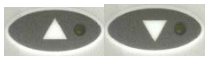
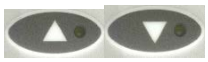
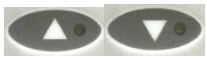
To avoid it being lost, the “Ferrite Wand“ is stored inside of the detector head control panel, fixed to the back wall of the panel. You can remove it by twisting the wand which disengages the plastic retaining latch. The wand can then be removed from the control panel and the panel refitted before carrying out the Ferrite Tune.

When refitting the head control panel cover, ensure that the fixing screws have been tightened to 4Nm torque to maintain the integrity of the IP69K rating for the head; preventing ingress of water or condensation.

When you are adding a new product to the system for inspection, you can select the “Dry“ product type option in the ***Menus > Set Up > Product*** menu. Then following a successful Full Learn process, the “Ferrite“ settings will be used for inspecting the new product.

To avoid accidental changes being made to the Ferrite product it is always hidden from display in the ***Menus > Service > Options*** menu following a Ferrite Tune.

To perform a ferrite tune, proceed as follows:

1.	Select ***Menus > Service > Options*** to display the **Service Options** menu options which are listed and described below.
2.	Use the **Navigation Keys**  to select the **Access Ferrite** option and press the **OK / Enter Key** to select it
3.	Use the **Navigation Keys**  to display the **YES** option and then press the **OK / Enter Key** to select it.
4.	Navigate to the ***Menus > Change*** menu, then use the **Navigation Keys**  to display the **Ferrite F** product and press the **OK / Enter Key** to select it.
5.	Perform a Full Learn whilst moving the end of the ferrite wand with the sample in and out of the search head; taking care not to put your hand in or get any watches/rings near the search head.

On systems fitted with a Product Registration Photo-eye, block the photo-eye to register that packs are present.

6.	Once a successful Learn has been completed, navigate back to the ***Menus > Service > Options*** menu and de-select the **Access Ferrite** option. You have now completed the Ferrite Tune process.

Setting Up Product Signal Tracking

General

This feature allows the detector to automatically adjust the working threshold between two pre-set limits to enable the sensitivity of the detector to be optimised in situations where the product signal drifts up and down with the change in product effect.

For instance, for a frozen product the product effect is very small when the product has just come out of the freezer allowing a low working threshold level to be used giving a high sensitivity to metal contaminants. However, if the line stops for any reason then the product could thaw slightly, or if the product were not fully frozen, a significant product signal increase would result. In this event the working threshold will have to be raised to allow the product to be passed, without false rejection. Raising the working threshold to allow softer product to pass without false rejection will reduce the sensitivity to metal contamination, i.e. larger pieces of metal will now be detected. If the product becomes hard frozen whilst the raised working threshold is still set the sensitivity to metal contamination will remain reduced because the working threshold is higher than it now needs to be.

Tracking works by recording the product signal for each pack. From the values read the working threshold continuously trends upwards or downwards between an upper and a lower limit.

The rate and amount by which the working threshold changes, together with limits between which it operates, are controlled by user entered parameters.

It must be understood that this type of system may allow metal contamination that would otherwise be detected when the product is fully frozen, to be accepted if product softening has forced the working threshold to rise.

Operating Conditions

The Tracking limits parameters are only available if the Tracker option has been enabled in the ***Menus > Service > Options*** menu. For this option to be available, a Product Registration Photo-eye must be fitted and enabled in the ***Menus > Service > Configuration > System*** menu.

Tracking is product relative and the function can be turned on or off individually for each of the available 100 product memories.

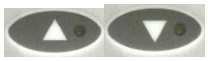
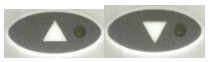
Tracker initialisation will occur whenever:

- The detector is powered on.
- The running product is changed.
- The Tracking limits parameters are changed in the User Options screen.

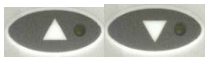
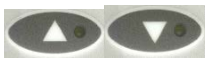
Upon completion of a product Learn process the derived working threshold will be used unless the product signal initiates a change. See Enabling the Tracker Feature for further details.

Enabling the Tracker Feature

To enable the tracker feature, proceed as follows:

1.	Select ***Menus > Service > Options*** to display the **Options** menu options.
2.	Use the **Navigation Keys**  to select the **Tracker** option and press the **OK / Enter Key** to enable the current value to be edited.
3.	Use the **Navigation Keys**  to select the **YES** option then press the **OK / Enter Key** to confirm the selection.
4.	Repeat steps 2 and 3 above to select the required values for the **Month**, **Day**, **Date**, **Hours** and **Minutes** options.

To set the parameters to be used by the tracker feature, proceed as follows:

1.	Select ***Menus > Set Up > Tracker Limits*** to display the **Tracker Limits** menu options.
2.	Use the **Navigation Keys**  to select the first option and press the **OK / Enter Key** to enable the current value to be edited.
3.	Use the **Navigation Keys**  to select the value required then press the **OK / Enter Key** to confirm the selection.
4.	Repeat steps 2 and 3 above to select the required values for the **Month**, **Day**, **Date**, **Hours** and **Minutes** options.

The Tracker feature allows the detector to automatically adjust the working threshold for a product between Maximum and Minimum limits set in this screen, to enable the sensitivity of the detector to be optimised in situations where the product signal drifts up and down with changes in product effect.

The Tracker Limits menu options available are as follows:

- **Tracker Limits**

  To display the options listed below you must first enable them by selecting the YES option. The following options are then displayed:

  - **Min limit**

    This option is used to set the lowest product signal level to be used by the Tracker feature when making automatic threshold adjustments. The value defaults to the working threshold calculated by the detector during the product Learn process and cannot be set any lower than this value. But you can manually increase the Min limit value if required.

  - **Max limit**

    This field is used to set the highest product signal level to be used by the Tracker feature when making automatic threshold adjustments. The value defaults to twice the working threshold calculated by the detector during the product Learn process. The value cannot be set less than the Minimum limit but may be manually increased up to the value of your choice.

    It is strongly advised to set this value to just greater than the typical amount by which the product signal is expected to change. All signals that exceed this value will be rejected.

  - **Max limit (lock)**

    Once the Max limit value for the product signal has been entered the value can be locked to prevent an automatic change during a re-Learn process.

  - **Adjustment**

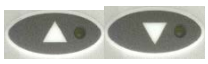
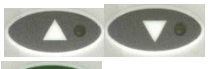
    This option is used to set a percentage by which the product signal threshold may be changed.

  - **Number of packs**

    This field is used to manually set the number of packs to be included in the Tracker calculations. The range is 1 – 100, where 100 provides the finest control. The default value is 10.

Setting Up the Reject Options

To set up the reject options, proceed as follows:

1.	Select ***Menus > Service > Reject > Set Up*** to display the **Reject Set Up** menu options which are listed and described below.
2.	Use the **Navigation Keys**  to select each option in turn press the **OK / Enter Key** to enable the value to be edited.
3.	Use the **Navigation Keys**  to select the required option value and then press the **OK / Enter Key** to confirm the selection.
4.	Repeat step 2 and 3 until you have selected and confirmed values for each option.

The Reject Set Up menu options available are as follows:

- **Mode**

  The following Mode options are provided for selection:

  - **Pulse (only available if a photo-eye is fitted)**

    If this option is selected, when a contaminated package is detected the reject delay time is counted down, in order for the package to travel from the photo-eye to the reject device, where-upon the reject is turned on for a time equal to the reject dwell time. Typically, this mode of reject would be used for air blast or pusher type rejects for the accurate rejection of small packages at high speed.

  - **Pulse Extension**

    This option provides the same functionality as the Pulse option, except that the dwell time is extended if a second contaminated product reaches the reject point before the dwell time from the first contaminated product has timed out. This could typically be used with an air blast or retracting band reject device, but not a pusher type device. This reject mode is always available.

  - **Toggle (only available if a photo-eye is fitted)**

    If this option is selected, when a contaminated package is detected the reject delay time is counted down, in order for the package to travel to the reject device, where upon the reject device state is toggled.

*The **Reject dwell** option will not be displayed for configuration in the **Menus > Service > Options** menu as it is not used.*

  - **Dwell Extension**

    If this option is selected, when a contaminated product is detected the reject device is immediately activated, and stays activated for a time equal to the reject dwell time. If a second reject product is detected before the dwell time has timed out, then the dwell time is counted down from the beginning again.

*The **Reject delay** option will not be displayed for configuration in the **Menus > Service > Options** menu as it is not used.*

  - **Reject till accept:**

    If this option is selected, when a contaminated product is detected the delay time is timed out, at which point the reject device becomes activated. The reject device will then stay activated until an uncontaminated product reaches the reject point.

*The **Reject dwell** option will not be displayed for configuration in the **Menus > Service > Options** menu as it is not used.*

- **Reject Relay**

  The reject relay can be set to be either normally energised or normally de-energised. For fail safe applications, the relay state should be normally energised so that if there is a fault in the reject system the relay will drop out causing rejection of all product.

- **Reject Timing**

  Two reject timing options are available for selections as follows:

- **Product relative**

  If this option is selected, you can set the Reject dwell and delay times to different values for each product.

- **Universal**

  If this option is selected, the Reject dwell and delay times set in this menu are initially used for all products.

  Changing the values for one product will then automatically update the values for all other products and also the values set in this menu.

- **Reject Confirm**

  Enable this option if a Reject Confirmation Photo-eye is fitted to your system. This photo-eye is fitted across the entrance to the reject bin to confirm that the contaminated product has entered the bin. A system fault is generated if a confirmation signal is not received by the detector.

- **Pack check**

  Select this option to ensure that packs that are counted onto the detector conveyor are counted off. This option also helps to ensure that packs that should have been rejected, but did not enter the reject bin, do not leave the detector conveyor by stopping it. This option only appears if a Product Registration Photo-eye has been fitted and enabled in the ***Menus > Service > Configuration > System*** menu and the Pack Check Photo eye has been installed.

- **Bin full**

  Enable this option if a bin full sensor has been fitted to your system. This sensor is fitted inside the bin towards the top. As contaminated products stack up inside the bin, once they break the sensor beam a system fault is generated to warn the operator that the bin must be emptied.

- **Double bag**

  Select this option to reject products if the length is longer than expected. For example, bags in a continuous stream may need to be separated prior to being inspected and this separation may have failed, resulting in a double-bag entering the detector. This option is only available if a Product Registration Photo-eye has been installed.

In addition to the above, the following option is available for selection in the ***Menus > Service > Reject > Control*** menu:

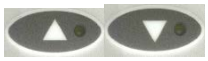
- **Disable rejects?**

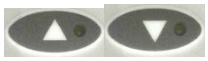
  Selecting this option temporarily disables the reject device. This feature is intended for Loma Service Engineer use only.

Adding a New Product

This section explains how to add a new product, following which a Full Learn should be carried out to capture and save the metal detector settings for inspecting the product.

To add a new product, proceed as follows:

1.	Select ***Menus > Set Up > Product*** to display the **Product** menu options which are listed and described below.
2.	Use the **Navigation Keys**  to select the Product no (product number) option and press the **OK / Enter Key** to enable the value to be edited.

3.	Use the **Navigation Keys**  to select an unused product number and then press the **OK / Enter Key** to confirm the selection.
4.	Repeat steps 2 and 3 to scroll through all of the Product menu options until you have selected and confirmed values for each option.

The Product menu options available are as follows:

- **Product No (number)**

  Each product must have a unique product number which is used by the software to store the product settings for recall when the product is selected to be run.

- **Name**

  To assist with identification and selection, you should give all products a unique name, which can be up to 25 alphanumeric characters in length.

- **Product type**

  The available options for selection are described below.

  - **0 Unknown**

    This is the default option and is recommended for selection if you are in any doubt whether the other options available are more appropriate. In effect you are letting the detector decide which product type is most suitable to use.

    If during the product Learn process no product effect is exhibited, the detector will automatically select the Dry option anyway.

  - **0 Dry**

    Select this option if you are sure that the product will exhibit no product effect. The detector will then use the pre-set ferrite phase angle rather than learn from the actual product.

    If during the product Learn process a product effect is exhibited, the detector will advise that the Learn process has failed. You should then set the Product type to Unknown and repeat the learn process.

  - **0 Metal film**

    Select this option if the product to be inspected is foil packed.

    Note that this option will only appear if the Auto-Frequency option **is** selected and the Dry Working Mode option **is not** selected in the ***Menus > Learn > Set Up*** menu.

- **Flow length**

  The Flow length option is displayed if a Product Registration Photo-eye is in use and the PEC enable option has been selected in the ***Menus > Service > Configuration > System*** menu. The detector needs to know the length of the pack to enable it to function correctly.

  Measure the product diagonally and enter that length to provide some tolerance and avoid the generation of false triggers and nuisance error messages; for example where the external packaging has curled up or packs are presented too close together. Then enter the pack length in millimetres.

- **Reject delay**

  The following should be noted before setting up the Reject Delay and Reject Dwell timing for a product.

Setting reject times is best done by passing the product, contaminated by a detectable metal test sample, through the machine and the adjusting the delay (time or distance from detect to reject) and dwell (time or distance the reject device operates for) to obtain a clean removal of the contaminated product from the transport into the reject collection device. All units of time are in seconds.

For systems where a Product Registration Photo-eye is not being used, the reject delay time is the time in seconds between when a contaminant is detected in a product to when the reject device is activated to remove it from the production line.

The position of the contaminant within the product (length) will directly affect the reject delay. You must therefore make allowances in the delay time to ensure that wherever the contaminant is located in the product a clean rejection is achieved.

For systems where a Product Registration Photo-eye is used, reject delay timing is always timed from when the leading edge of the product activates the photo-eye regardless of where in the product the metal contamination is situated.

When using variable speed systems, the delay is timed by distance which is entered in metres in the Reject delay field. See the ***Menus > Service > Configuration > System*** menu to view the available speed mode options.

Enter the reject delay time in seconds, or for variable speed systems, enter the distance in metres.

- **Reject dwell**

  Reject dwell is the time or distance that the reject device operates for to remove a contaminated product from the conveyor belt and into the reject collection device. It must therefore be set to ensure clean removal of the contaminated product.

  Please read through the information contained in the Reject delay section above for further guidance. Reject timings may also be set in the ***Menus > Service > Reject > Set Up*** menu.

  Enter the reject dwell time in seconds, or for variable speed systems, enter the distance in metres.

- **PVS Test**

  Select this option if you are using the Performance Validation System to carry out product testing at specific times and have configured this in the ***Menus > Set Up > PV Test Set Up*** menu. You can also access the PVS Log to view the test details.

Learning Products

An essential part of inspecting products is to set up the metal detector parameters specifically for each product to optimise the detectors performance for each one. Loma metal detectors provide a Learn feature which automates this process.

The Learn settings and the process to be followed is defined in the ***Menus > Learn > Set Up*** and ***Menus > Service > Configuration > Learn Limits*** menus.

Note that the ***Menus > Learn > Set Up*** menu is only available if the **Set Up Learn** option has been enabled in the ***Menus > Service > Options*** menu.

The metal detector provides three alternative Learn processes:

- **Full Learn**

  This process must be carried out initially on all products as it automatically configures and populates the system settings and parameters based on effect of the product on the electromagnetic field as the product passes through the inspection aperture.

  The product samples used for the Learn process must be free of metal contaminants and fully representative of the normal products to be inspected.

  Following a Full Learn, any manual adjustment to the settings for a product can be accessed through the ***Menus > Learn > Set Up*** menu. See the Full Learn section for further details.

- **Update Learn**

  This process is only available if you have previously carried out a Full Learn process for the product. It fine-tunes the phase value to minimize the signal, while still checking for metal in the product. Use an Update Learn to update the signal when the production line is running if false rejects are occurring because the signal has drifted.

  See the Update Learn section for further details.

- **Reverse Learn**

  This process is only available if the Reverse Mode option has been enabled in the ***Menus > Service > Options*** menu screen. It is used in situations where for example a product must contain a contaminant, perhaps a toy car or whistle, and the metal detector is being used to reject products that do not contain one.

  Both the Full and Update Learn processes can be selected and run from the Learn Set Up menu when the detector is in Reverse Mode.

See also the Learn Messages section which lists the messages that may be displayed by the metal detector during a Learn process and provides an explanation for each one.

Full Learn

Prior to carrying out a Full Learn, ensure that you have a number of representative sample products available to pass through the detector as part of the process.

The Learn process utilises the currently selected product so ensure that you select the correct product through the ***Menus > Change*** menu before continuing.

To perform a Full Learn for a product, proceed as follows:

1.	Select ***Menus > Learn*** to display the **Learn** menu and select the **Full** option.	
2.	Press the **OK / Enter Key** to start the Full Learn process. The name and number of the product being learnt are displayed.	
3.	A 'WAIT' message is then displayed.	
4.	This is followed by a 'PASS PRODUCT' message.	
5.	When the 'PASS PRODUCT' message is displayed, start to pass products through the detector.	
6.	A 'Learning' message is then displayed, along with a number which signifies either the time in seconds remaining to pass products if a Photo-eye is not fitted, or the number of product packs remaining to be passed if a Photo-eye is fitted.	
7.	Once the Learn process is finished a 'Learn Complete' message is displayed.	

Additional messages may be displayed during the Learn process which are listed and explained in the Learn Messages section.

Update Learn

Prior to carrying out an Update Learn, ensure that you have a number of representative sample products available to pass through the detector as part of the process.

The Learn process utilises the currently selected product so ensure that you select the correct product through the ***Menus > Change*** menu before continuing.

To perform an Update Learn for a product, proceed as follows:

1.	Select ***Menus > Learn*** to display the **Learn** menu and select the **Update** option.	
2.	Press the OK / Enter Key to start the Update Learn process. The name and number of the product being learnt are displayed.	
3.	A 'WAIT' message is then displayed.	
4.	This is followed by a 'PASS PRODUCT' message.	
5.	When the 'PASS PRODUCT' message is displayed, start to pass products through the detector.	
6.	A 'Learning' message is then displayed, along with a number which signifies either the time in seconds remaining to pass products if a Photo-eye is not fitted, or the number of product packs remaining to be passed if a Photo-eye is fitted.	
7.	Once the Learn process is finished a 'Learn Complete' message is displayed.	

Additional messages may be displayed during the Learn process which are listed and explained in the Learn Messages section.

Learn Messages

The table below lists the messages that may appear during a Learn process and provides some guidance.

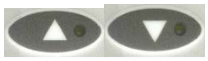
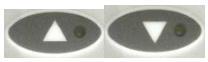
Message	Explanation
+Use ferrite+	This only applies when performing a ferrite tune and indicates that either the ferrite wand is not being passed through the machine or that there is insufficient ferrite material in the wand. Check that the wand being used is the one supplied with the machine.
+Head overload+	The message indicates that the gain cannot be reduced any further to stop the head overloading. Possible reasons for this could be: ■ The sample pack being used contains a large contaminant. ■ A product not specified for use with the machine is being used. ■ The product packaging is highly conductive. If in doubt, contact your local Loma Service Centre.
+Working dry+	This message indicates that the product has so little moisture that it produces no product signal. The detector will automatically set the Working Mode to DRY.
+Bad pack+	This message indicates that the product signal being received exceeds the **Max Threshold** option value set in the ***Menus > Learn > Set Up*** menu. This could be because the sample pack being used contains a contaminant or the **Max Threshold** option value has been set too low. Check that the sample packs being used are representative of production packs. For example, if a frozen product is being learnt are the sample packs still frozen? If in doubt, contact your local Loma Service Centre.
+Adjusting+	The head is reducing the Gain and/or Frequency settings to account for the product effect of the product.
+Head locked+	The head is using the **Head Gain** value entered in the ***Menus > Learn > Setup*** menu rather than determining the value itself as the **Head Gain** option has been set to **LOCKED**.
+Mode locked+	The head is using the **Working Mode** value entered in the ***Menus > Learn > Setup*** menu rather than determining the value itself as the **Working Mode** option has been set to **LOCKED**.
+Dry product+	The product has little or no product signal and therefore the wrong Working Mode option may have been locked in the ***Menus > Learn > Setup*** menu.
+Learn complete+	The Full Learn process has been completed successfully.

Learn Setup

The product Learn parameters for optimum detector performance are automatically selected during a Full Learn process so no manual adjustment of the parameters is normally required.

If adjustments are required then you should contact your local Loma Service Centre in the first instance.

To manually adjust the product Learn parameters, proceed as follows:

1.	Select ***Menus > Learn > Set Up*** to display the **Set Up** menu options which are listed and described below.
2.	Use the **Navigation Keys**  to select each option in turn and press the **OK / Enter Key** to enable the value to be edited.
3.	Use the **Navigation Keys**  to select the required option value and then press the **OK / Enter Key** to confirm the selection.
4.	Repeat step 2 and 3 until you have selected and confirmed values for each option.

The Set Up menu options available are as follows:

- **Auto-Frequency**

  If this option is enabled, the operating frequency to be used by the detector for the product being Learnt is automatically selected.

  If the option is not enabled then the Frequency to be used can be manually selected in the Frequency option.

- **Frequency**

  The operating frequency for the detector, assigned to a product memory, is displayed or can be selected when operating manually.

- **Working mode**

  The level of transmitter power is selected here by selecting options of P-Mode, Q-Mode or Dry.

  The mode is automatically selected during a Full Learn process but may be manually set if required. For products with no electrical conductivity the Dry option should be selected

- **Working**

  Enabling this option locks the Working mode setting, thus preventing the detector from changing it during a Full Learn process.

- **Min threshold**

  The value entered here sets the lowest threshold that the detector can set during any Learn process.

- **Max threshold**

  The value entered here sets a level that during any Learn process if exceeded will abort the process. Its purpose is to prevent a successful Learn being achieved for a contaminated sample product.

- **Detection Threshold**

  This is the detectors working threshold, set automatically after a completed Learn process. It may be manually set here if required.

- **P span threshold**

  This field is only displayed if the PQ span option is enabled in the ***Menus > Service > Configuration > Learn Limits*** menu. It is used to set the P span signal threshold (Pmax – Pmin) to be used during inspection.

- **Q span threshold**

  This field is only displayed if the PQ span option is enabled in the ***Menus > Service > Configuration > Learn Limits*** menu. It is used to set the Q span signal threshold (Qmax – Qmin) to be used during inspection.

- **Compensation**

  This is the product compensation set automatically from a Learn process. It cannot be manually changed.

- **Phase angle**

  This is the product compensation angle computed from a Learn process. It may be manually set here if required.

- **Phase**

  Enabling this option locks the phase angle so that the detector cannot change it during a Learn process.

- **Head drive**

  The level of transmitter power is selected here from options of MAX (maximum) full power, MED (medium) half power and LOW quarter power.

  For dry products the level is normally set to MAX.

  For difficult products such as metal film or products with a high or non-uniform level of conductivity, a lower drive setting may achieve a better result.

- **Head**

  Enabling this option locks the Head drive setting, thus preventing the detector from changing it during a Full Learn process.

- **Head P gain**

  The signal level of the P channel (in phase signal) is adjusted here. The adjustment is made automatically during a Full Learn process based on the product effect on the electromagnetic field.

  Manual adjustment is not recommended unless absolutely necessary. Options of MAX, MED, LOW and MIN are available for selection.

- **Head Q gain**

  The signal level of the Q channel (90 degree phase signal) is adjusted here. The adjustment is made automatically during a Full Learn process based on the product effect on the electromagnetic field.

  Manual adjustment is not recommended unless absolutely necessary. Options of MAX, MED, LOW and MIN are available for selection.

- **Head RF gain**

  This is a specialised setting for use with metallised film or very difficult conductive products. The head RF gain is adjusted through the software by changing the setting in this screen but may also be adjusted manually through the fitting of links onto the Transmitter Board.

  The software adjustment is made automatically during a Full Learn process based on the product effect on the electromagnetic field.

  Manual adjustment is not recommended unless absolutely necessary. Options of MAX, MED, LOW and MIN are available for selection.

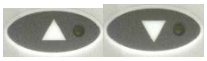
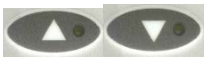
- **Head Gain**

  Enabling this option locks the Head Gain settings, thus preventing the detector from changing them during a Full Learn process.

Learn Limits

The Learn Limits menu provides options to set up some parameters for the Learn process and to enable the display of other parameters in the ***Menus > Learn > Set Up*** menu so that their values may be manually set if required.

To update any options in the Learn Limits menu, proceed as follows:

1.	Select ***Menus > Service > Configuration > Learn Limits*** menu to access the available options which are listed and described below.
2.	Use the **Navigation Keys**  to select each option in turn press the **OK / Enter Key** to enable the value to be edited.
3.	Use the **Navigation Keys**  to select the required option value and then press the **OK / Enter Key** to confirm the selection.
4.	Repeat step 2 and 3 until you have selected and confirmed values for each option.

The Learn Limits menu options available are as follows:

- **PQ Gain**

  This option is used to set the initial P and Q gain levels to be used when starting a Full Learn process.

  Options of Min, Low, Med and Max are available for selection, with Max being the default value.

- **RF Gain**

  This option is used to set the initial RF gain level to be used when starting a Full Learn process.

  Tap the arrow to the right of the field to display a drop down list of options for setting the gain level to be used. Options of Min, Low, Med and Max are available, with Med being the default value.

- **Normal drive**

  This option is used to set the drive level used when carrying out a Full Learn process when the Unknown or Dry Product type option has been selected in the ***Menus > Set Up > Product*** menu.

  Options of Min, Low, Med, High and Max are available for selection, with High being the default value.

- **Film drive**

  This option is used to set the drive level used when carrying out a Full Learn process when the Metal film Product type option has been selected in the ***Menus > Set Up > Product*** menu.

  Options of Min, Low, Med and High are available for selection, with Low being the default value.

- **Threshold**

  This option is used to set the maximum signal value to be used during a Full Learn process. If the signal exceeds this threshold then the frequency is automatically reduced. The default value is 5000.

- **Learn cycle**

  The following options for setting the Learn cycle to be used are available for selection:

  0 Short

  If a Product Registration Photo-eye is fitted, selecting this option means that when a Learn process is started, the system requests that you pass 8 packs (product samples) through the detector. The number of packs to be passed is displayed on the screen, reducing as each pack is passed. Once all 8 packs have been passed the screen closes.

  If a Product Registration Photo-eye is **NOT** fitted, selecting this option means that when a Learn process is started, the system requests that you pass packs (product samples) through the detector for a period of 20 seconds. The time remaining to pass packs is displayed on the screen. Once the time available has reduced to zero the screen closes.

  0 Long

  If a Product Registration Photo-eye is fitted, selecting this option means that when a Learn process is started, the system requests that you pass 20 packs (product samples) through the detector. The number of packs to be passed is displayed on the screen, reducing as each pack is passed. Once all 20 packs have been passed the screen closes.

  If a Product Registration Photo-eye is **NOT** fitted, selecting this option means that when a Learn process is started, the system requests that you pass packs (product samples) through the detector for a period of 60 seconds. The time remaining to pass packs is displayed on the screen. Once the time available has reduced to zero the screen closes.

- **Tolerance**

  This option is used to add a percentage safety margin to the product signal threshold, captured and set during the Learn process, to allow for any small variances in product signal values during normal running conditions.

  Tap the arrow to the right of the field to display a drop down list of options for setting the Tolerance percentage to be used. Options of Min, Low, Med, High and Max are available, with Med being the default, providing around 15% of tolerance.

- **PQ Saturation learn limit**

  This option is used to set the maximum saturation signal value to be used during a Full Learn process. If the signal exceeds this limit then the gain or frequency is automatically reduced.

- **PQ Saturation run limit**

  This option is used to set the maximum saturation signal value to be used whilst the system is in run mode. If this value is exceeded a SAT message is displayed.

- **PQ span?**

  Enabling this option displays the P span threshold and Q span threshold options in the ***Menus > Learn > Set Up*** menu. This option requires a Product Registration Photo-eye to be fitted.

- **Noise threshold**

  This option is used to set the P,Q signal value below which the Product type option value is automatically set to Dry in the ***Menus > Set Up > Product*** menu. The default value is 20.

Using Performance Validation

This section describes the benefits of the Performance Validation System and explains how to set up the metal detector for PV testing, with information about each of the parameters that need to be specified.

Regular checking of the metal detector's sensitivity should be a normal part of any quality assurance procedure. This is particularly important should it become necessary to demonstrate due diligence to address customer or legislative requirements.

One approach is to make regular sensitivity checks and keep handwritten records of the results.

To assist in maintaining quality assurance controls the metal detector includes an automatic Performance Validation System. This can be set up to automatically prompt the operator to perform quality assurance checks on a regular basis. It then guides the operator through a test sequence using standard test samples. At the end of the Performance Validation test the results are saved in memory and can be outputted in a number of ways.

See the Logs and Reports section for further details.

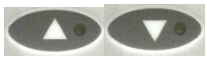
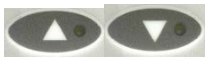
Setting Up PV Testing

To use PV testing the PV Test option must be set to YES in the ***Menu > Service > Options*** menu. The ***Menus > Set Up > PV Test Set Up*** menu will then become available.

A series of options the allow you to specify how the performance validation test operates and these are described below.

*The **PV Test Set Up** menu is not available if the **Reverse Mode** option has been set to **YES** in the **Menus > Service > Options** menu.*

To set up PV testing, proceed as follows:

1.	Select ***Menus > Set Up > PV Test Set Up*** to display the **PV Test Set Up** menu options which are listed and described below.
2.	Use the **Navigation Keys**  to select each option in turn press the **OK / Enter Key** to enable the value to be edited.
3.	Use the **Navigation Keys**  to select the required option value and then press the **OK / Enter** to confirm the selection.
4.	Repeat step 2 and 3 until you have selected and confirmed values for each option.

The PV Test Set Up menu options available are as follows:

- **Test type**

  The following options are available for setting the test type to be used.

  0 Normal

  Selecting this option enables the normal test process. The size of the Fe (Ferrite), Nfe (Non-Ferrite) and S.St (Stainless Steel) test wands being used must first be entered and menu options are available for these.

  When the PV test starts the user will be prompted to pass a sample product pack with the Fe test wand type attached through the detector where it will be inspected to confirm that the metal contaminant in the test wand can be detected

If it cannot then a warning message will be displayed and a larger metal contaminant may need to be used. Once a successful inspection of the Fe test wand has been completed, the user is prompted to pass the same sample product pack with the test wand attached through the detector a number of times, set in the Number of passes option, until they have all passed inspection and the test is complete in the PVS screen as shown below.

The user is then prompted to repeat the above process for the Nfe and then the S.St test wands.

Once all testing has been completed successfully, normal inspection can be continued.

The test wands are colour coded RED – Fe (Ferrite), GREEN – NFe (Non-Ferrite) and BLUE – S.St (Stainless Steel).

0 Sequential

Selecting this option enables the sequential process which is basically the same as the Normal process with the exception that each of the test wand types is passed one after the other through the detector rather than one type at a time until they have all passed inspection and the test is complete.

- **Timing**

The following options are available for setting the test timing to be used.

0 Off

Selecting this option means that the user will initiate a PV test manually from the ***Menus > Run PV Test*** menu.

0 Interval

Selecting this option means that the user will be automatically prompted to initiate a PV test after a specified time, subject to a minimum interval of 6 minutes.

0 Batch

Selecting this option means that the user will be automatically prompted to initiate a PV test when a new batch is started or when a batch ends.

A Product Registration Photo-eye must be fitted to use the Interval and Batch options.

- **Test Window**

This option is only displayed when either the Interval or Batch Test timing option is selected. It is used to set a length of time in minutes to successfully complete a PV test, commencing from the generation of the prompt. When using the Interval Test timing option, the length of time set cannot be shorter then the time set in the Interval field.

- **Number of passes**

This field is displayed for all test types and timing options. It is used to set the number of passes required for each test wand type to complete a PV test.

- **Guidance on determining the number of passes to be used**

  For products that exhibit no product effect and where no Product Registration Photo-eye is fitted, place each test wand type onto the product sample at the leading edge for the first pass and then on the trailing edge for the second pass to ensure that the change of reject timing point still results in the correct rejection of the product. A minimum of two passes per test wand type is therefore suggested.

  For products that exhibit no product effect but where a Product Registration Photo-eye is fitted, you can place each test wand type anywhere within the product length. In this case a minimum of one pass per test wand type is sufficient.

  For products that exhibit a product effect, regardless of whether a Product Registration Photo-eye is fitted, place each test wand type onto the product sample at the leading edge for the first pass, in the middle for the second pass and on the trailing edge for the third pass to ensure not only that the reject timing is correct for non photo-eye systems but also to obtain better detection coverage of the product sample itself. A minimum of three passes per test wand type is therefore suggested.

- **Fe Test**

  In this option you can enter the ferrous (chrome steel) test piece size in mm to be used for PV testing.

  Leave the option value blank if this test piece should not be used as part of the PV test.

- **Non-Fe Test**

  In this option you can enter the non-ferrous (brass) test piece size in mm to be used for PV testing.

  Leave the option value blank if this test piece should not be used as part of the PV test.

- **St. Steel Test**

  In this option you can enter the stainless steel (normally 304 annealed) test piece size in mm to be used for PV testing.

  Leave the option value blank if this test piece should not be used as part of the PV test.

- **False Threshold**

  The false threshold value is used to detect when metal test pieces are larger in size than those specified by the PV test.

  If this threshold is exceeded at any time during a test it does not count towards a successful test. All PV test samples must be passed correctly for the PV test to be successful.

  To ensure the correct false threshold value is entered, note the signal values obtained whilst passing all the test pieces used. The ideal false threshold value is the largest signal obtained plus a small margin added for error.

  If you are not sure what margin for error to apply, test with the next size up test pieces, note the values obtained and then set the threshold about midway between the largest signal value from the test pieces to be used and the largest signal value from the next size up.

  Note that PVS test pieces are not recorded in the Contaminants Log or included within the reject count.

- **Sample in stats**

  Enabling this option includes the packs passed during the PV test process in the Batch Log statistics.

Running a Performance Validation Test

To run a PV test, proceed as follows:

1.	To manually run a PV test, select ***Menus > Run PV Test*** to display the **Run PV Test ?** menu and press the **OK / Enter Key** to confirm that you want to run the test. Where PV testing is being automatically initiated the **Run PV Test ?** menu is automatically displayed.	
2.	The Operator id option will be displayed. Press the **OK / Enter Key** to select the field for editing and then enter your Operator ID.	
3.	The test will advise you of the type and size of the first test wand to be used, previously specified in the **PV Test Set Up** menu.	
	Note that if no test sample sizes have been programmed then the display will show **+No Samples+** and a report will be produced immediately.	
4.	You will then be prompted to pass test sample packs through the detector until the FE test is complete.	
5.	Follow the prompts to repeat steps 3 and 4 for the NFE and SS tests until the test is complete.	

To cancel a PV test, proceed as follows:

1.	To cancel the PV test, just press the **Cancel Key** at any time to return to the **Run PV Test ?** menu. If the test was initiated manually, no error is generated. If the test was initiated automatically, a non-action error is recorded and a report is generated.	

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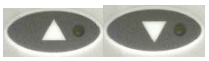
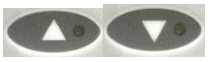
Logs and Reports

This chapter provides information about the available logs and reports that are generated from information automatically collected by the IQ^3 Metal Detector.

To produce any report a Serial Link must have been previously set up to match the device receiving the report. Once a link has been established, any active report may be produced.

Reports

To set up the report options, proceed as follows:

1.	Select ***Menus > Set Up > Report Options*** to display the **Report Options** menu options which are listed and described below.
2.	Use the ***Scroll*** buttons  to select each option in turn press the ***Tick*** button to enable the value to be edited.
3.	Use the ***Scroll*** buttons  to select the required option value and then press the ***Tick*** button to confirm the selection.
4.	Repeat step 2 and 3 until you have selected and confirmed values for each option.

The Report Options menu provides the following options:

- **Form Feed**

  When this option is enabled a page break is included between each report being printed. Options of YES (enabled) and NO (disabled) are provided for selection.

- **Carriage Return**

  When this option is enabled, each report is started at the beginning of the next new line. Options of YES (enabled) and NO (disabled) are provided for selection.

- **All Reports**

  When this option is enabled, all available reports are made available for selection and sending to the connected device, instead of having to scroll down the list and select them individually. The individual reports options will therefore not be displayed for selection. Options of YES (enabled) and NO (disabled) are provided for selection.

- **Reports**

  Menu options are a available for selecting the following Reports. Options of YES (enabled) and NO (disabled) are provided for selection.

  - **Errors Report**
  - **Faults Report**
  - **Setup Report**
  - **Contaminants Report**
  - **Learn Report**
  - **Status Report**
  - **PV Test Report**

- Batch Report
- Shift Report

Logs

The IQ^3 Metal Detector captures event data relating to Contaminants, Errors, Faults, Batches, PV tests and Shifts which are then made available for viewing.

Each log can hold up to 20 records. If this number is exceeded and the log has not been sent as a report, then the oldest record is deleted to provide space for a new record.

The ***Menus > Logs*** menu displays the following Logs for viewing:

- Contaminants Log
- Errors Log
- Faults Log
- Batch Log
- PVS Log
- Shift Log

Errors Report

Purpose

Run errors are classed as non serious but may require an operator's attention. When an error is generated, the attention relay operates and subsequently any remote device connected to it.

This report is useful for monitoring the types of errors being generated that interrupt production and looking for potential trends so that improvements may be made to reduce production down time.

Running the Report

To run the report, navigate to the ***Menus > Logs > Errors*** menu, scroll down to the **Errors Report?** menu option and then press the **OK / Enter Key**. The report will then be generated and sent over the serial link to the connected device.

Report Contents

The report contains a list of the last run errors recorded, up to a maximum of 20, under the following column headings:

- **Date** – Displays the date that the error occurred.
- **Time** – Displays the time that the error occurred.
- **Machine Identification** - Displays the Machine ID.
- **Total Number of Errors** - Displays the number of errors included in the report.

The following details are then provided for each Error included in the report:

- **Error** - Displays a brief description of the reason why the error has been generated. See Example problems below.
- **Occurred** – Displays the date and time that the Error occurred.
- **Error status is** – Displays the current status of the error:
  - **ACT (Active)** – The error is current and has not been cleared.
  - **EVT (Event)** – The error has been cleared.
  - **PSV (Passive)** – The error has been listed for advice only

Example Problems

Some example run error problems that may be displayed and suggested remedial actions are listed below.

- **Problem:** PV test prompt - an automatic programmed PV test prompt has occurred.
  - **Action:** Complete a PV Test.
- **Problem:** PEC blocked - the product registration photo-eye has remained blocked for greater than several (the default is 6) consecutive pack lengths.
  - **Actions:**

    Check the PEC for blockage. This is often caused by product backup on the line.

    Check the PEC is working correctly.

    Check the pack flow length entry is adequate in the ***Menus > Set Up > Product*** menu, ensuring an allowance is made for pack skew.

    Ensure that the correct belt speed is entered in the ***Menus > Service > Configuration > System*** menu.
- **Problem:** Neg delay exten(sion) - reject dwell time setting problem. Variable speed systems only.
  - **Action:** Check the reject delay and dwell time settings in the ***Menus > Set Up > Product*** menu.
- **Problem:** Speed too fast - belt speed is greater than the upper limit for filter resistors, coil gap and belt speed combination. Variable speed systems only.
  - **Action:** Decrease the belt speed in the ***Menus > Service > Configuration > System*** menu.
- **Problem:** Speed too slow - belt speed is less than the lower limit for filter resistors, coil gap and belt speed combination. Variable speed systems only.
  - **Action:** Increase the belt speed in the ***Menus > Service > Configuration > System*** menu.
- **Problem:** Rejects too close - the reject system is still counting out the dwell for a reject when the next pack to be rejected needs to be rejected.
  - **Actions:**

    Reduce the reject dwell time in the ***Menus > Set Up > Product*** menu.

    The pack length for product registration photo-eye operation may be too short. Increase the entered length in the ***Menus > Set Up > Product*** menu.

    Improve the pack pitch.

    If the reject is a retracting band or lift/drop flap, change the reject mode to pulse extension in the ***Menus > Service > Reject > Set Up*** menu.
- **Problem:** Reject disabled - the reject relay has been manually disabled.
  - **Action:** Enable the reject relay using the Reject enable command in the ***Menus > Service > Reject > Set Up*** menu.
- **Problem:** Calib-in-run abort - a signal that has exceeded the currently set value for maximum threshold in the learn setup menu has been exceeded during a learn cycle.
  - **Action:** Product used for learn is probably contaminated. Select an alternative product for learning in the ***Menus > Change*** menu.

- **Problem:** Drive overload - This is a warning message advising that the drive current for the selected operating frequency has increased and is approaching the upper limit. If the upper limit is exceeded, this will cause the transmitter to operate in 100kHz safe mode. If safe mode is entered, then the detector operation will be affected and may cause false rejects or poor metal sensitivity.
    - **Action:** Go to ***the Menus > Service > Configuration > Drive Settings*** menu and select the same frequency that was running when the error occurred. It may be that the Drive On time has been manually increased. Decrease the value of the Drive On time entry incrementally, until the displayed drive current (in the same menu) is in the region of 230 - 250mA. Note that detectors with large apertures will have drive currents below the normal 230 - 250mA range if operating at frequencies above 650kHz. If the message persists or the user is in doubt then contact your local Loma Service Centre for assistance.

Faults Report

Purpose

System faults are classified as serious and require immediate action. When a fault is generated the fault relay operates, permanently, operating the reject device and/or stopping the conveyor transport, and must be cleared in the ***Menus > Logs > Faults*** menu by selecting the **Clear Faults?** option.

This report is useful for monitoring the types of faults being generated that interrupt production and looking for potential trends so that improvements may be made to reduce production down time.

Running the Report

To run the report, navigate to the ***Menus > Logs > Faults*** menu, scroll down to the **Faults Report?** menu option and then press the **OK / Enter Key**. The report will then be generated and sent over the serial link to the connected device.

Report Contents

The report contains a list of the last system faults recorded, up to a maximum of 20, under the following column headings:

- **Date** – Displays the date that the error occurred.
- **Time** – Displays the time that the error occurred.
- **Machine Identification** - Displays the Machine ID.
- **Total Number of Faults** - Displays the number of faults included in the report.

The following details are then provided for each Fault included in the report:

- **Fault** - Displays a brief description of the reason why the fault has been generated. See Example problems below.
- **Occurred** – Displays the date and time that the fault occurred.
- **Error status is** – Displays the current status of the fault:
    - **ACT (Active)** – The error is current and has not been cleared.
    - **EVT (Event)** – The error has been cleared.
    - **PSV (Passive)** – The error has been listed for advice only.

Example Problems

Some example system faults problems that may be displayed and suggested remedial actions are listed below.

- **Problem:** 5V out of spec - the 5V rail is less than 4.75V.
    - **Action:** Contact your local Loma service centre for assistance.

- **Problem:** +12V out of spec - the +12V rail is less than 11.40V.
  - **Action:** – Contact your local Loma service centre for assistance.
- **Problem** – Verdict too late - a pack has arrived at the reject point before the detector has sent a reject decision.
  - **Actions:**

    1. Increase the reject delay time in the ***Menus > Set Up > Product*** menu.

    2. If a product registration photo-eye is installed, reduce the pack length (flow length) in the ***Menus > Set Up > Product*** menu.
- **Problem:** Verdict mismatch - the system has more reject verdicts than packs passed.
  - **Action:** Power the machine off and on.
- **Problem:** Rej confirm fail - the reject system has attempted to reject a pack but could not confirm that the pack entered the reject bin and was removed from the line, within the specified time. When this fault occurs, the conveyor should be cleared before the transport can be restarted.
  - **Action:**

    If the pack has been correctly rejected:

    1. Check the reject confirmation sensor is working.

    2. Check the reject confirmation timing parameters are correct in the ***Menus > Service > Reject > Set Up*** menu.

    If the pack has not been correctly rejected, the transport system will have stopped:

    1. Collect and remove from the line all product/s both in the aperture and after the detector. If there is any possibility that the contaminated product may have left the detector transport system, then any possible contaminated product beyond the detector transport will need to be cleared as well. It is advised that any removed product be properly identified and securely segregated from good product.

    2. Recheck the setup parameters and the function of the reject and confirm systems before restarting the line.
- **Problem:** Rej con wind fail - reject confirm window failure. The reject confirmation system has detected two packs in one reject confirm window.
  - **Actions:**

    1. Check for the possibility of a single pack double triggering the reject confirmation photo-eye.

    2. If two packs were supposed to be rejected than reduce the Reject confirmation window time in the ***Menus > Service > Reject > Set Up*** menu.

    3. Reduce the reject dwell time in the ***Menus > Set Up > Product*** menu. .
- **Problem:** Confirm sensor fault - the reject confirm sensor has been blocked for greater than the Reject confirmation timeout.
  - **Actions:**

    1. Check the sensor for blockage.

    2. Check the sensor is working correctly.

- **Problem:** Bin full - the reject bin full sensor has been blocked for longer than 5 seconds and the transport system has stopped. The bin will need to be emptied before the transport can be restarted.
  - **Action:**

    If the bin is full:

    1. Remove, identify and segregate the product. Once the sensor is unblocked the fault will automatically clear.

    If the bin is not full:

    1. Check the Bin full sensor is working correctly.

- **Problem:** Link corrupted - data corruption has occurred between the detector and LomaLink PC or other controlling device. The operation of the detector is unaffected.
  - **Action:**

    1. Check cabling and link connectors from remote device.

    2. Check LomaLink PC or other controlling device for reported errors.

- **Problem:** Link failure - a break in communication between the detector and LomaLink PC/other controlling device. The operation of the detector is unaffected.
  - **Action:**

    1. Check cabling and link connectors from remote device.

    2. Check connections between the detector and LomaLink PC or other controlling device for loose or broken wiring/connectors.

- **Problem:** PV test timeout - an automated prompt for the PV test has either not been actioned or completed within the window time set. The transport system may have stopped.
  - **Action:** Clear system fault (restart the transport if stopped) and perform a PV test.
- **Problem:** PEC obstructed - the product registration photo-eye has remained blocked for greater than 6 consecutive pack lengths. This fault is only generated if the PEC fault is enabled.
  - **Actions:**

    1. Check the PEC for blockage.

    2. Check the PEC is working correctly.

    3. Check pack flow length entry is adequate in the ***Menus > Set Up > Product*** menu, ensuring an allowance is made for pack skew.

    4. Ensure the correct belt speed is entered in the ***Menus > Service > Configuration > System*** menu..

- **Problem:** Wrong flash c/sum - the software has compared the flash checksum currently stored in its memory with the checksum for recently installed software. This occurs if a software update has been done and a hardware cold start was not performed after installation.
  - **Action:**

    1. Perform an update to the Flash Checksum in the ***Menus > Machine Details*** menu.

2. Perform a hardware cold start by moving link JP6 across pins 1-2 from 2-3 on the Control Board, then power on/off This will wipe all system and product setup data from the detector. Therefore a complete setup of the detector will be required. This should only be done in the event of extreme difficulties. Return the link to its original position before entering any data.

- **Problem:** Drive too low - (IQ3 only) the transmitter drive current is not set.
  - Action: In the Menus > Service > Configuration > Drive Settings menu perform the Auto Configure operation. This will automatically reset all the drives for each of the detector operating frequencies. This will take several minutes to complete. This action will not affect any other detector settings.

Setup Report

Purpose

The Setup Report is automatically created and sent when changing product or can be manually requested from the Setup Report screen.

When automatically sent, the report is for the product being changed to. When manually requested it is for the current running product. The report contains product and learn setup data.

Running the Report

To run the report, navigate to the ***Menus > Set Up > Product*** menu, scroll down to the **Setup Report?** menu option and then press the **OK / Enter Key**. The report will then be generated and sent over the serial link to the connected device.

Report Contents

The report contains information for the machine and currently selected product in several sections as described below.

- **Product Details Report** - This section contains some general information and a list of the options available in the *Menus > Product > Set Up?* menu with their associated values and selections.
  - **Time** - Displays the time that the report was generated.
  - **Date** - Displays the date that the report was generated.
  - **Machine Identification** - Displays the Machine ID.
  - **Product ID** - Displays the Product number
  - **Product type** - Displays the product type.
  - **Flow length** - Displays the flow length value (mm) set for the product.
  - **Reject delay length** - Displays the reject delay length of time (s) set for the product.
  - **Reject dwell length** - Displays the reject dwell length of time (s) set for the product.
  - **PV test** - Displays **YES** or **NO** to indicate if PV testing has been enabled for the current product.
- **Learn Setup** – This section includes a list of the options available in the ***Menus > Learn > Set Up?*** menu, as shown below, and their associated values and selections.
  - **Auto frequency**
  - **Frequency**
  - **Working Mode**

- **Working Mode Lock**
- **Minimum Threshold**
- **Maximum Threshold**
- **Detection Threshold**
- **Product Compensation**
- **Phase Angle**
- **Phase Lock**
- **Head Drive**
- **Head Drive Lock**
- **Head P Gain**
- **Head Q Gain**
- **Head RF gain**
- **Head Gain Lock**

Contaminants Report

Purpose

The Contaminants Report contains a complete record of reject activity which is useful for monitoring and analysing the occurrences and levels of contamination for specific products.

Running the Report

To run the report, navigate to the ***Menus > Logs > Contaminants*** menu, scroll down to the **Contaminants Report?** menu option and then press the OK / Enter Key. The report will then be generated and sent over the serial link to the connected device.

Report Contents

The report contains a list of the last inspection records where contaminants were detected, up to a maximum of 20, under the following column headings:

- **Date** – Displays the date that the report was generated.
- **Time** – Displays the time that the report was generated.
- **Machine Identification** - Displays the Machine ID.
- **Number of Contaminants** - Displays the number of contaminant records included in the report.

The following details are then provided for each Contaminant included in the report:

- **Occurred** – Displays the date and time that the contaminant was detected.
- **Threshold** – Displays the signal threshold set up for the product.
- **Peak Signal** - Displays the peak signal received when the contaminant was detected.

Learn Report

Purpose

The Learn Report provides useful information covering when product Learn processes were carried out and the Learn settings used which can then be used for product investigations; providing confirmation that the Learn processes were carried out for specific products and that the detector was able to identify the types and sizes of contaminants used.

Running the Report

The report is automatically created and sent over the serial link to the connected device each time the product Learn function is completed.

Report Contents

The report contains some general information and a list of the options available in the ***Menus > Learn > Set Up?*** menu with their associated values and selections.

- **Time** – Displays the time that the report was generated.
- **Date** – Displays the date that the report was generated.
- **Machine Identification** – Displays the machine ID.
- **Product Number** – Displays the product number.
- **Product type** – Displays the product type.
- The following options available in the ***Menus > Learn > Set Up?*** menu and their associated values are then included:
    - **Auto Frequency**
    - **Frequency**
    - **Working Mode**
    - **Working Mode Lock**
    - **Minimum Threshold**
    - **Maximum Threshold**
    - **Detection Threshold**
    - **Phase Angle**
    - **Phase Lock**
    - **Head P Gain**
    - **Head Q Gain**
    - **Head Drive**
    - **Head Lock**

Status Report

Purpose

The Status Report contains accumulated product run data for the currently running product at the time it is sent to assist in investigating problems with specific products and batches.

Running the Report

To run the report, navigate to the ***Menus > Results*** menu, select the **Status Report?** option and press the **OK / Enter Key**. The report will then be generated and sent over the serial link to the connected device.

Report Contents

The report contains information the following information:

- **Time** – Displays the time that the report was generated.
- **Date** – Displays the date that the report was generated.
- **Machine Identification** – Displays the machine ID.
- **Product Number** – Displays the product number.
- **Product name** – Displays the product name.
- **Batch start time** – Displays the batch start time.
- **Batch finish time** – Displays the batch finish time.
- **Number of packs passed** - Displays the total number of packs passed through the detector for the batch.
- **Number of good packs** - Displays the number of packs accepted.
- **Number of bad packs** – Displays the number of packs rejected.
- **Maximum Signal** - Displays the maximum product signal detected for the batch.
- **Average Signal All** - Displays the average product signal detected for all packs passed through the detector for the batch.
- **Average Signal Good** - Displays the average product signal detected for just the number of good packs accepted.

PV Test Report

The PV Test Report contains a record of completed in-line detector performance testing activity which is useful for providing compliance evidence and when carrying out investigations.

Running the Report

The report is automatically created and sent over the serial link to the connected device each time a PV test is completed.

Report Contents

The report contains some general information and a list of the options available in the ***Menus > Set Up > PV Test Set Up*** menu with their associated values and selections.

- **Date** – Displays the PV test date.
- **Time** – Displays the PV test time.
- **Machine Identification** - Displays the Machine ID.
- **Product Number** – Displays the product number.

- **Product name** - Displays the product name.
- **Operator ID** – Displays the entered identity of the test operator.
- **Test Samples Ferrous** – Displays the number of passes and the size of the Ferrous test piece used.
- **Test Samples Non Ferrous** – Displays the number of passes and the size of the Non-Ferrous test piece used.
- **Test Samples Stainless** – Displays the number of passes and the size of the Stainless Steel test piece used.
- **Detection Threshold** – Displays the working threshold limit for the product tested.
- **False Threshold** – Displays the false threshold used for the test.
- **PV Test Prompt** – Displays the status of the PV test prompt option, being either **ON** or **OFF**.

Batch Report

Purpose

The Batch Report contains a record of completed batch information. Batches can be compiled on a time basis or on a count basis where the Production Registration PEC is fitted.

This log is useful for monitoring and analysing batch reject rates per product so that improvements may be made to reduce production costs and also for monitoring product signals to review whether the detector power may be adjusted to improve performance.

Running the Report

The report is automatically created and sent over the serial link to the connected device each time a Batch is completed.

Batch completion may be automatically triggered by expiry of a time period or inspection of a specified number of packs. This is set up in the ***Menus > Set Up > Batch Control*** menu.

Batch completion may also be manually triggered by resetting the batch data in the ***Menus > Results*** menu.

Report Contents

The report contains information for the last 20 batches completed under the following column headings:

- **Date** – Displays the date that the report was generated.
- **Time** – Displays the time that the report was generated.
- **Machine Identification** – Displays the machine ID value.
- **Product number** - Displays the unique product number.
- **Product Identification** - Displays the product name.
- **Batch start time** - Displays the time that the batch started.
- **Batch finish time** - Displays the time that the batch finished.
- **Number of packs passed** – Displays the total number of packs inspected for the batch.
- **Number of good packs** - Displays the number of packs in the batch that passed inspection.
- **Number of bad packs** - Displays the number of packs in the batch that were rejected.
- **Maximum Signal** - Displays the maximum product signal detected during the batch.
- **Average Signal All** - Displays the average product signal across all packs inspected in the batch.

- **Average Signal Good** - Displays the average product signal for all products that passed inspection in the batch.

Shift Report

Purpose

The Shift Report contains a record of completed shift information. Shifts are compiled on a time basis.

This report is useful for monitoring and analysing shift reject rates so that improvements may be made to reduce production costs.

Running the Report

The report is automatically created and sent over the serial link to the connected device each time a shift is completed.

Report Contents

The report contains shift information under the following column headings:

- **Date** – Displays the date that the report was generated.
- **Time** – Displays the time that the report was generated.
- **Machine Identification** – Displays the machine ID value.
- **Shift start time** - Displays the time that the shift started.
- **Shift finish time** - Displays the time that the shift finished.
- **Shift duration** - Displays the time in hours and minutes that the shift lasted.
- **Number of good packs** - Displays the number of accepted packs inspected during the shift.
- **Number of bad packs** – Displays the number of rejected packs inspected during the shift.

Contaminants Log

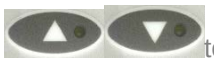
Purpose

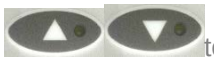
The Contaminants Log contains records of reject activity which is useful for monitoring and analysing the occurrences and levels of contamination for specific products.

The log can hold up to 20 records. If this number is exceeded and the log has not been sent as a report, then the oldest record is deleted to provide space for a new record.

Viewing the Log

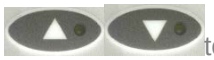
To view the Contaminants Log, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **Contaminants** option.
2.	Use the **Navigation Keys**  to display the **View Contaminants Log?** menu option.
3.	Press the **OK / Enter Key** to select the option. If the log is empty a +Log empty+ message is displayed.
4.	If the log contains entries then the number of entries is briefly displayed.

5.	Use the **Navigation Keys**  to scroll through each of the available log entries.
7.	Each entry is displayed in turn and contains three lines of information for each one.
8.	The first line displays the **Product Signal**, the second line displays the **Time** and the third line displays the **Date**.

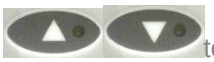
Printing the Contaminants Report

To print a copy of the Contaminants Report, proceed as follows:

1.	Select ***Menus*** **>** ***Logs*** to display the **Logs** menu and select the **Contaminants** option.
2.	Use the **Navigation Keys**  to display the **Contaminants Log Report?** menu option.
3.	Press the **OK / Enter Key** to select the option. The report will then be generated and sent over the serial link to the connected device.

Clearing the Log

To clear the Contaminants log, proceed as follows:

1.	Select ***Menus*** > ***Logs*** to display the **Logs** menu and select the **Contaminants** option.
2.	Use the ***Scroll*** buttons  to display the **Clear Contaminants Log?** menu option.
3.	Press the **OK / Enter Key** to select the option. The Contaminants log will be automatically cleared and the message +Contaminants cleared+ is displayed.

Errors Log

Purpose

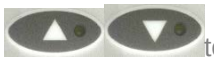
Run errors are classified as non serious but may require an operator's attention. When generated the attention relay operates and subsequently any remote device connected to it.

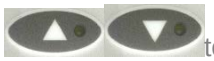
The Errors Log contains records of run errors generated which is useful for monitoring and analysing the occurrences and types of errors being generated for specific products.

The log can hold up to 20 records. If this number is exceeded and the log has not been sent as a report, then the oldest record is deleted to provide space for a new record.

Viewing the Log

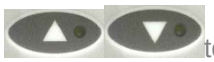
To view the Errors Log, proceed as follows:

1.	Select ***Menus*** **>** ***Logs*** to display the **Logs** menu and select the **Errors** option.
2.	Use the **Navigation Keys**  to display the **View Errors Log?** menu option.

3.	Press the **OK / Enter Key** to select the option. If the log is empty a +Log empty+ message is displayed.
4.	If the log contains entries then the number of entries is briefly displayed.
5.	Use the **Navigation Keys**  to scroll through each of the available log entries.
7.	Each entry is displayed in turn and contains three lines of information for each one.
8.	The first line displays the **Error name**, the second line displays the **Time** and **Error code** and the third line displays the **Date**.

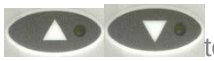
Printing the Errors Report

To print a copy of the Errors Report, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **Errors** option.
2.	Use the **Navigation Keys**  to display the **Errors Log Report?** menu option.
3.	Press the **OK / Enter Key** to select the option. The report will then be generated and sent over the serial link to the connected device.

Clearing the Log

To clear the Errors log, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **Errors** option.
2.	Use the **Navigation Keys**  to display the **Clear Errors Log?** menu option.
3.	Press the **OK / Enter Key** to select the option. The Errors log will be automatically cleared and the message +Errors cleared+ is displayed.

Faults Log

Purpose

System faults are classified as serious and require immediate action. When a fault is generated the fault relay operates, permanently operating the reject device and/or stopping the conveyor transport.

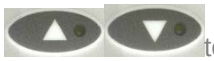
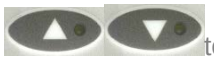
This log is useful for monitoring the types of faults being generated that interrupt production and looking for potential trends so that improvements may be made to reduce production down time.

The log can hold up to 20 records. If this number is exceeded and the log has not been sent as a report, then the oldest record is deleted to provide space for a new record.

Viewing the Log

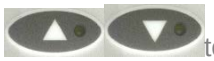
To view the Faults Log, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **Faults** option.

2.	Use the **Navigation Keys**  to display the **View Faults Log?** menu option.
3.	Press the **OK / Enter Key** to select the option. If the log is empty a +Log empty+ message is displayed.
4.	If the log contains entries then the number of entries is briefly displayed.
5.	Use the **Navigation Keys**  to scroll through each of the available log entries.
7.	Each entry is displayed in turn and contains three lines of information for each one.
8.	The first line displays the **Fault name**, the second line displays the **Time** and **Fault code** and the third line displays the **Date**.

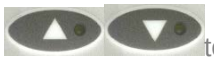
Printing the Faults Report

To print a copy of the Faults Report, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **Faults** option.
2.	Use the **Navigation Keys**  to display the **Faults Log Report?** menu option.
3.	Press the **OK / Enter Key** to select the option. The report will then be generated and sent over the serial link to the connected device.

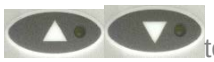
Clearing a Fault

To clear a Fault, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **Faults** option.
2.	Use the **Navigation Keys**  to display the **Clear Faults?** menu option.
3.	Press the **OK / Enter Key** to select the option. The Fault will be automatically cleared and the message +Fault cleared+ is displayed.

Clearing the Log

To clear a the Faults Log, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **Faults** option.
2.	Use the **Navigation Keys**  to display the **Clear Faults Log?** menu option.
3.	Press the **OK / Enter Key** to select the option. The Faults log will be automatically cleared and the message +Faults cleared+ is displayed.

Batch Log

Purpose

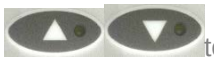
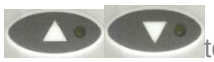
The Batch Log contains a record of completed batch information. Batches can be compiled on a time basis or a count basis where the Production Registration PEC is fitted.

This log is useful for monitoring and analysing batch reject rates per product so that improvements may be made to reduce production costs.

The log can hold up to 20 records. If this number is exceeded and the log has not been sent as a report, then the oldest record is deleted to provide space for a new record.

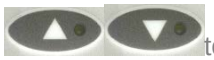
Viewing the Log

To view the Batch Log, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **Batch** option.
2.	Use the **Navigation Keys**  to display the **View Batch Log?** menu option.
3.	Press the **OK / Enter Key** to select the option. If the log is empty a +Log empty+ message is displayed.
4.	If the log contains entries then the number of entries is briefly displayed.
5.	Use the **Navigation Keys**  to scroll through each of the available log entries.
7.	Each entry is displayed in turn and contains four lines of information for each one.
8.	The first line displays the **Product number**, the second line displays the **Rejects number**, the third line displays the **Time** and the fourth line displays the **Date**.

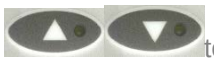
Printing the Batch Report

To print a copy of the Batch Report, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **Batch** option.
2.	Use the **Navigation Keys**  to display the **Batch Log Report?** menu option.
3.	Press the **OK / Enter Key** to select the option. The report will then be generated and sent over the serial link to the connected device.

Clearing the Log

To clear the Batch log, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **Batch** option.
2.	Use the **Navigation Keys**  to display the **Clear Batch Log?** menu option.
3.	Press the **OK / Enter Key** to select the option. The Batch log will be automatically cleared and the message +Batch cleared+ is displayed.

PVS Log

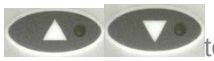
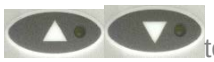
Purpose

The PVS Log contains records of completed in-line detector performance testing activity which is useful for providing compliance evidence and when carrying out product investigations.

The log can hold up to 20 records. If this number is exceeded and the log has not been sent as a report, then the oldest record is deleted to provide space for a new record.

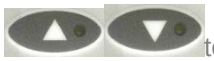
Viewing the Log

To view the PVS Log, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **PVS** option.
2.	Use the **Navigation Keys**  to display the **View PVS Log?** menu option.
3.	Press the **OK / Enter Key** to select the option. If the log is empty a +Log empty+ message is displayed.
4.	If the log contains entries then the number of entries is briefly displayed.
5.	Use the **Navigation Keys**  to scroll through each of the available log entries.
7.	Each entry is displayed in turn and contains four lines of information for each one.
8.	The first line displays the **Product number**, the second line displays the **PVS title**, the third line displays the **Time** and the fourth line displays the **Date**.

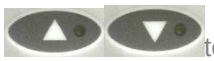
Printing the PVS Report

To print a copy of the PVS Report, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **PVS** option.
2.	Use the **Navigation Keys**  to display the **PVS Log Report?** menu option.
3.	Press the **OK / Enter Key** to select the option. The report will then be generated and sent over the serial link to the connected device.

Clearing the Log

To clear the PVS log, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **PVS** option.
2.	Use the **Navigation Keys**  to display the **Clear PVS Log?** menu option.
3.	Press the **OK / Enter Key** to select the option. The PVS log will be automatically cleared and the message +PVS cleared+ is displayed.

Shift Log

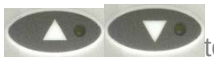
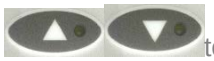
Purpose

The Shift Log contains a record of completed shift information. Shifts are compiled on a time basis.

This log is useful for monitoring and analysing shift reject rates per product so that improvements may be made to reduce production costs. The log can hold up to 20 records. If this number is exceeded and the log has not been sent as a report, then the oldest record is deleted to provide space for a new record.

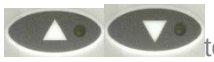
Viewing the Log

To view the Shift Log, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **Shift** option.
2.	Use the **Navigation Keys**  to display the **View Shift Log?** menu option.
3.	Press the **OK / Enter Key** to select the option. If the log is empty a +Log empty+ message is displayed.
4.	If the log contains entries then the number of entries is briefly displayed. The log can hold a maximum of 20 entries after which any new entries will overwrite the oldest entry.
5.	Use the **Navigation Keys**  to scroll through each of the available log entries.
7.	Each entry is displayed in turn and contains five lines of information for each one.
8.	The first line displays the **Accepts number**, the second line displays the **Rejects number**, the third line displays the **Finish time**, the fourth line displays the **Duration** and the fifth line displays the **Date**.

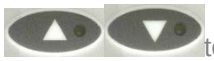
Printing the Shift Report

To print a copy of the Shift Report, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **Shift** option.
2.	Use the **Navigation Keys**  to display the **Shift Log Report?** menu option.
3.	Press the **OK / Enter Key** to select the option. The report will then be generated and sent over the serial link to the connected device.

Clearing the Log

To clear the Shift log, proceed as follows:

1.	Select ***Menus > Logs*** to display the **Logs** menu and select the **Shift** option.
2.	Use the **Navigation Keys**  to display the **Clear Shift Log?** menu option.
3.	Press the **OK / Enter Key** to select the option. The Shift log will be automatically cleared and the message +Shift cleared+ is displayed.

Maintenance

This chapter describes the maintenance procedures for the IQ^3 Metal Detector.

Your warranty may be invalidated if you do not follow the maintenance schedule set out within this user guide. This warranty statement is in addition to the terms of sale.

The following sections provide more information:

- **Maintenance Warnings**

  A list of applicable safety warnings to be observed when maintaining the metal detector head is provided.

- **Cleaning**

  This section provides guidance for cleaning the metal detector.

- **Air Regulator Unit Maintenance**

  This section provides some guidance covering maintaining the compressed air regulator.

- **Conveyor Belt Maintenance**

  This section provides some guidance covering maintaining the conveyor belt.

- **Adjusting the Reject Devices**

  This section provides some guidance covering adjustment of the reject devices.

- **Software Upgrades**

  This section provides some guidance for upgrading the metal detector software.

Maintenance Warnings

The following safety warnings apply when carrying out maintenance operations on an IQ^3 Metal Detector:

1. LETHAL HAZARD – ELECTRICAL SUPPLIES
2. LETHAL HAZARD – COMPRESSED AIR SUPPLIES
3. NON-IONIZING RADIATION
4. WORKING ON EQUIPMENT
5. REJECT DEVICES

For details see the Safety Warnings section.

Cleaning

Cleaning regime

A typical cleaning regime consists of the 5 stages.

- **Pre-rinse**
- **Detergent rinse**
- **Rinse**
- **Disinfectant rinse**
- **Final rinse**

Never immerse the Pneumatic Actuator as internal corrosion and permanent damage will result.

Cleaning solutions

Detergents are typically alkaline solutions. Disinfectants typically contain Chlorine or Ammonia. Every 3-4 weeks it is typical to revert to acid based cleaning solution to remove any build up of lime scale on stainless steel parts.

For specific cleaning applications please refer to the supplier of the cleaning solutions. Always observe safety data sheet provided by the manufacturer of the cleaning solutions.

If chlorine based cleaning solutions are used on grade 304/304L stainless steel there is a risk of corrosion appearing within a short time. A higher specification ‚marine grade' 316 stainless offers more resistance to corrosion by virtue of its molybdenum content.

Cleaning will reduce/eliminate microbiological contamination to an acceptable level. Prior to a production run a swab test should be carried out to ensure that the required level of hygiene is maintained for food production.

Both the Standard and Harsh versions of the metal detector have been designed and tested to meet IP69K water pressure between 1160 - 1450 psi @ between 3.69 - 4.2 gallons per minute @ 80 centigrade.

Water is sprayed @ a distance between 3.9 - 5.9 inches @ angles of 0, 30, 60 & 90 degrees for 30 seconds @ each angle. Nema equivalent is PW12 which is slightly less rigorous.

Prior to starting cleaning procedures ensure that the head control panel cover fixing screws have been tightened to 4Nm torque to maintain the integrity of the IP69K rating for the head; preventing ingress of water or condensation.

Belt conveyor versions

- Isolate the electrical and pneumatic supplies to the conveyor.
- If your conveyor system uses a harsh construction search head (white plastic liner) then hose down or steam cleaning can be used in place of washing with mild detergents.
- If fitted remove the reject container. Empty and wash with mild detergent.
- Brush any loose debris off the exposed conveyor surfaces and belt scraper if fitted.
- Wash conveyor, detector aperture, rollers, skid plate and underside of belt using mild detergent.
- Rinse and dry thoroughly all washed areas.
- Inspect the conveyor belt for signs of damage.
- Where an air regulator unit is fitted check the water build up in the trap and drain off as described in Air Regulator Unit Maintenance.
- Check the security of all conveyor-guarding systems.
- Reconnect power and air systems.
- Where interlocked guarding is fitted check the conveyor stops when the guards are opened.
- For PU belted conveyors check the belt tension and belt tracking. Belt tensioning and tracking is described in Setting the Belt Tension and Tracking.
- For plastic modular belt conveyors check for belt damage. For replacing individual sections see Plastic Modular Belt Conveyor Versions – Belt Section Replacement.
- Check the correct operation of the reject system. Advice can be found in the Good Practice section.

- For systems with reject confirm and bin full check their correct operation. Bin full will operate if the sensor is blocked for > 5 seconds.

Air Regulator Unit Maintenance

With the exception of systems fitted with Air Blast or Stop-On-Detect or electrically driven rejects the compressed air supply pressure to the fitted reject device is fed through an air regulator unit. The particular model of regulator may vary according to the specification of the system. Each type will have a pressure adjustment control air input and output fittings a pressure gauge and water trap.

Adjustment of the air pressure is normally carried out by pulling up the adjustment knob to release the lock and by turning the control clock or anti-clockwise the pressure can be adjusted.

Removal of water from the water trap bottle is carried out by operation of a rotating knob or by pressing a button. Either way the control will be located at the bottom of the water trap bottle. Water should be removed regularly.

The correct setting of the air pressure can be found in the individual system specifications in the Technical Specifications chapter.

Conveyor Belt Maintenance

Plastic Modular Belt Section Replacement

- If product guides are fitted to the conveyor, unscrew the retaining screws and remove the guides.
- Clamp the belt either side of one of the plastic hinge pins that are used to join the sections of the belt together that require changing.

If you do not clamp the belt it will roll off the loose sprockets when you remove the pin.

- Carefully slide out the plastic hinge pins and remove the section of belt to be replaced.
- Carefully interlock the new section of the belt. Make sure the belt is located on the drive sprocket and correctly engage with the other ‘floating’ sprockets.
- Carefully slide the plastic hinge rods through the interlocked sections of belt.
- If product guides were removed from the conveyor, refit them in position and tighten the securing screws.

Setting the Belt Tension and Tracking

If the belt slips or moves during normal operation, check the rollers are clean and free from debris and greasy elements then follow the steps below.

Adjusting the hexagonal lock nuts on the studs of the four hanger bearings at the ends of the conveyor facilitates belt tracking and tension adjustment for this type of conveyor. Do not over-tension the belt as this may cause premature wear to the bearings.

- Main belt tensioning is controlled by the hanger bearings at the drive end of the conveyor. This is factory set and must not be adjusted on site.
- Tracking and minor tension adjustment is controlled by the hanger bearings at the idle end of the conveyor. Increasing the tension on the right-hand side of the belt will cause the belt to move to the left. A decrease in tension on the right will cause the belt to move to the left. Adjust until the belt track is central.

Adjusting the Drive Chain Tension

The conveyor belt drive chain is tensioned by undoing the four bolts holding the motor and moving the motor until the correct tension of 5mm maximum free play at the central point between the pulleys is achieved.

Adjusting the Reject Devices

Pusher and Retracting Band Rejects

At the reject solenoid valve, adjust the two throttle screws, in conjunction with the reject delay and dwell times set in the Rejects Setup screen, until the required reject timing and speed of operation are obtained. Both the reject timing and the speed of operation are affected by the air pressure supplied to the conveyor.

Air Blast Reject

Since this type of reject has no throttles, the only variables that can be adjusted are the reject delay and dwell times set in the Rejects Setup screen. There is no air regulator supplied as standard with the air blast reject. However, the air supply pressure should be approximately 100psi (6.9 bar).

Software Upgrades

This section provides details for upgrading the IQ^3 Metal Detector software.

Pre-requisites for upgrading are a copy of the latest software and help files, and a USB memory stick which is used to import the latest software, overwriting the existing software installed on the machine.

The following files are required and are available from Loma systems:

- **IQ3_vX.X.X.Xs.hex** – This file contains the operating software for the metal detector. The s in the file name signifies that it can be installed on systems that only have 2 x 2 MB (4 MB) flash ROMs fitted in positions U1 and U2 on the Control Board.
- **IQ3_vX.X.X.X.hex** – This file contains the operating software for the metal detector. It can be installed on systems that have an 8 MB flash ROM fitted in position U5 on the Control Board.
- **IQ3_Plus_vX.X.X.X._zip** - This file contains the GUI software required to operate the touch screen.
- **Matching HEX and GUI codes.txt** – This file can be opened in Notepad and provides additional information covering software versions, including a cross reference table between the Hex Code file versions and their matching GUI Code files to ensure that compatible versions of each file are installed.
- **Help_vX.X.X.X.zip** – This zipped folder contains a number of language sub-folders which each contain translated help text files. The set of files used by the software depends on the language selected in the Language Setup screen when setting up the metal detector.

The Xs used in the file names above have been used to substitute the version numbers. So for example the current GUI software version is IQ3_Plus_v1.9.2.10._zip at the time of writing this document.

1. Obtain a copy of the applicable upgrade files for your system from Loma Systems.
2. Insert a USB memory stick into your PC and copy the following files onto it:

   IQ3_vX.X.X.Xs.hex

   IQ3_vX.X.X.X.hex

3. Create a new folder on the USB memory stick called **IQ3_Plus_vX.X.X.X** using the version numbers on the source file.

4. Rename the IQ3_Plus_vX.X.X.X._zip file extension from ._zip to just .zip by removing the underscore. Then use WinZip or native Windowns functionality to extract all files into the folder you have just created on the USB memory stick.
5. Create a new folder on the USB memory stick called Help.
6. Then use WinZip or native Windowns functionality to extract all folders and files into the Help folder you have just created on the USB memory stick.
7. Eject and unplug the USB memory stick from your PC and plug it into the USB connector socket on the side of the control panel on the head of your metal detector.
8. Exit the Loma software on the metal detector using one of the following methods:

   Method 1: CTRL-TAB and End Task in the Main Run Screen.

   Method 2: Enter LOMA access level and pres ESC from the Main Run screen.

   Method 3: Tap on the Software icon in the System Settings screen to display the Software screen. Then scroll down to the bottom of the screen and tap on the Exit IQ+ software button.

9. Load the Explore task on the IQ+ panel using one of the following methods:

   Method 1: Plug in a USB keyboard and press Windows+E.

   Method 2: Double-click My Device on the desktop.

10. Navigate to the \FFSDISK\IQ3_GUI folder, then select and delete all the files and folders in the folder.
11. Navigate to the Hard Disk folder, which is the USB memory stick, then select and copy all of the files and folders.
12. Navigate to the \FFSDISK\IQ3_GUI folder and paste in the files and folders copied from the USB memory stick.
13. Reboot the IQ+ panel or alternatively navigate to the \FFSDISK\IQ3_GUI folder and double-tap on the IQ3_GUI.exe to run program. After a few minutes the main Run Screen will be displayed.
14. Check that the software has been updated by tapping on the Software icon in the System Settings screen to display the Software screen.

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Glossary

A

Aperture: The area through which product is passed.

AutoBalance: A patented detector feature that automatically makes balance adjustments for each of the 70 available frequencies to provide optimum detector performance.

B

Bin Full: Option which uses a PEC to indicate when a reject bin is full and needs to be emptied.

C

Conductivity: The measured amount of eddy current generation created on a metal surface.

D

Detector Performance: Relates to how well the metal detector can reliably detect metal contaminants,

E

Eddy Current: Small circulating electric currents generated when an electromagnetic field contacts the surface of a metal object. Secondary electromagnetic fields are generated by these currents and picked up by the receiver coils. This causes an inductive imbalance to occur between the transmitter and receiver coils which is used to identify and reject contaminated products.

Electromagnetic Field: An invisible electrical field emanating from a transmitter coil. This field is generated by the flow of alternating oscillator frequency current around the transmitter coil's windings.

F

False Triggering: Product rejects caused by external effects and not by a contaminant in the product itself.

Ferrous: A metal mainly composed of iron which also has magnetic properties.

Frequency: The number of alternating current cycles per second (Hz) produced by the transmit oscillator. The metal detector's electromagnetic operating frequencies are measured in Kilohertz (kHz). Low signal frequencies penetrate the product deepest, but sensitivity to smaller targets is low. Higher frequencies have a more shallow detecting depth but high sensitivity to small targets.

G

GUI: The controls used to set up and operate the metal detector.

L

Learn: The process of passing sample products through the metal detector so that it can automatically select the optimum detector settings based on the product effect.

M

Metal Free Zone: An area external to the metal detector aperture which must be free of any fixed or moving metal as it generates a signal that will be picked up by the metal detector

N

Noise: Electrical signals generated by local sources such as un-suppressed solenoids and inverters, which can cause False Triggering or reduce detection performance.

Non-Ferrous: A metal, including alloys, that does not contain any iron in appreciable amounts, is highly conductive and non-magnetic.

P

PEC: Photo-Electric Cell - Generates a beam of light which when broken by the passing of a product triggers an action through the software such as activating a reject device or updating a product count value.

Performance Validation: Regular testing of the detector performance to validate that it is operating correctly and detecting metal contaminants of the required type and size

Product Effect: Signals produced by the product when it is passed through an electromagnetic field that can be seen by the metal detector.

R

Reject: A product containing a detected metal contaminant that has been removed from the production line by the metal detector.

S

Serial Link: A network connection which allows the metal detector to communicate with another device connected to the network.

Shaft Encoder: A device fitted to variable speed conveyors to enhance accuracy of the reject timing.

Stainless Steel: An iron alloy which contains a minimum of 10.5% chromium and is corrosion and rust resistant.

T

Test Wand: Item that contains a spherical metal contaminant, of a specific type and size that is attached to a product to assist in

Threshold: Product signal limit, set as either a minimum or maximum value, which can be used to identify products for rejection.

Tracker: A feature which automatically adjusts the working frequency used to inspect the current product based on a calculated average product signal.

U

USB: Universal Serial Bus used to transfer data to and from the metal detector using a USB data stick.

User: A person who operates the metal detector. Different user access levels are available which are used to manage access to specific features and functionality.

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